A350
TECHNICAL TRAINING MANUAL
MAINTENANCE COURSE - T1+T2 - RR Trent XWB
Navigation

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V2414251 - V00T0MM0

AIR DATA AND INERTIAL REFERENCE SYSTEM DESCRIPTION (2/3)

General

The Air Data/Inertial Reference System (ADIRS) is an autonomous navigation system. The ADIRS gives air data, inertial reference (i.e. attitude and heading), A/C position (latitude and longitude) and A/C time reference.
The data are mainly sent to the CDS and Flight Management System (FMS).
The ADIRS is made of three subsystems which operate independently and which are redundant. Each subsystem has:
- One Air Data/Inertial Reference Unit (ADIRU)
- One MultiFunction Probe (MFP)
- Two Integrated Static Probes (ISPs)
- One Side Slip Angle (SSA) probe.

The ADIRS also has:
- One Outside Air Temperature 1 (OAT1) probe for ADIRU1
- One OAT2 probe, which is the same for ADIRU2 and ADIRU3
- One Angle Of Attack (AOA) probe for ADIRU1 only.

Each ADIRU has:
- One Air Data Reference (ADR) part that uses the probes and sensors data to compute the air data
- One Inertial Reference (IR) part that computes the inertial data.

The ADIRS interfaces with:
- The EFIS control panels, which give the barometric reference
- The Control and Display System (CDS)
- The Multi-Mode Receivers (MMRs), which give Global Navigation Satellite System (GNSS) data
- The Flight Management System (FMS) for initialization of ADIRS.

The ADIRS also sends to the different users the inertial speed and position data, the A/C time and the Global Positioning and Inertial Reference System (GPIRS) data.
Clock function
Each ADIRU hosts the clock function to give data (time UTC, date, etc.).
The initialization of ADIRU clock function is done on the GNSS data (if available) or the FMS data (pilot entry). If the GNSS data are not available, each ADIRU is able to give time data reference based on the GNSS or the FMS last data to all the users with their own internal clock. When all the ADIRUs are off, no time reference is broadcasted.
A unique Integrated Control Panel (ICP) is used to power and control the three ADIRUs.
AIR DATA switching can be initiated through a dedicated control installed on main instrument panel. Backup data can be manually selected on Captain or First Officer side.

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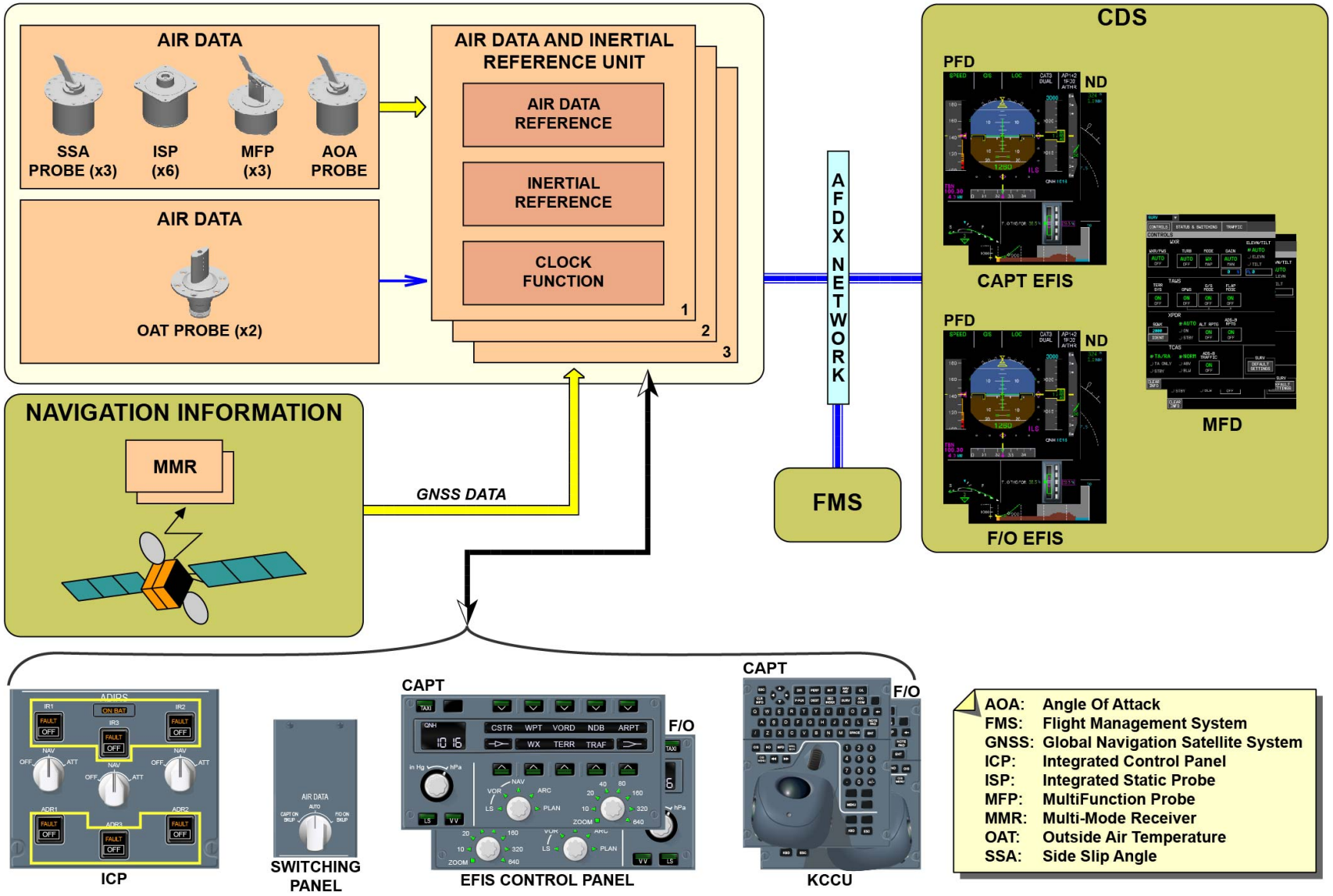
AIR DATA
SSA PROBE (x3)
ISP (x6)
MFP (x3)
AOA PROBE
AIR DATA
OAT PROBE (x2)
AIR DATA AND INERTIAL REFERENCE UNIT
AIR DATA REFERENCE
INERTIAL REFERENCE
CLOCK FUNCTION
1
2
3
AFDX NETWORK
CDS
PFD
ND
CAPT EFIS
PFD
ND
F/O EFIS
MFD
NAVIGATION INFORMATION
MMR
GNSS DATA
FMS
ADIRS
ICP
AIR DATA
SWITCHING PANEL
CAPT
F/O
EFIS CONTROL PANEL
CAPT
F/O
KCCU
AOA: Angle Of Attack
FMS: Flight Management System
GNSS: Global Navigation Satellite System
ICP: Integrated Control Panel
ISP: Integrated Static Probe
MFP: MultiFunction Probe
MMR: Multi-Mode Receiver
OAT: Outside Air Temperature
SSA: Side Slip Angle

GENERAL

AIR DATA AND INERTIAL REFERENCE SYSTEM DESCRIPTION (2/3)

Probes Description

The ADR part of each ADIRU is connected to the probes that follow:
- One MFP
- Two ISPs
- One SSA probe
- One OAT probe.

Each probe (excepted for OAT) includes an integrated digital converter and an integrated anti-icing regulation. The digital converter changes air data from analog to digital signals and transmits these data to the ADIRU through Aeronautical Radio Incorporated (ARINC) 429 buses.
All probes (excepted for OAT, which are directly energized by the ADIRUs for anti-icing) are supplied with 28VDC (electronic parts) and 115VAC (heating element).

Multifunction probes

The MFP gives:
- The Angle Of Attack (AOA)
- The Total Air Temperature (TAT)
- The total pressure (Pt).

The probe has:
- A rotating wing vane for the AOA measurement
- A tube to measure the TAT
- A pitot probe for the Pt.

There are three MFPs. Each ADIRU is connected to one MFP.
Each MFP transmits the data through ARINC 429 to the related ADIRU.

Integrated static probes

ISP gives the static pressure (Ps).
There are six ISPs. Each ADIRU is connected to two ISPs, one on each side of the fuselage.
Each ISP transmits the data through ARINC 429 to the related ADIRU.

Side slip angle probes

Each SSA probe has a rotating wing vane to measure the SSA.
There are three SSA probes. Each SSA transmits the data through ARINC 429 to the related ADIRU.

Outside air temperature sensors

The OAT sensors give an accurate OAT measurement on the ground and takeoff phases. The TAT sensor included in the MFPs usually gives the OAT, but the de-icing system disturbs the measurement on ground (that the airspeed usually compensates in-flight).
The OAT sensors are heat resisting probes. Only the ADIRUs energize them.
Each OAT sensor transmits an analog signal to the related ADIRU:
- One OAT probe connected to ADIRU1
- One OAT probe shared by ADIRU2 and ADIRU3.

Primary Flight Control System (PFCS) - Angle ofAttack Probes

For Load Alleviation Function (LAF) of PFCS, an AOA probe is mounted on L/H side of the A/C and is connected to the ADIRU1 for de-icing command and Built-In Test Equipment (BITE).

Power Supply

In normal configuration ADIRUs are supplied by DC buses. If the power source is lost, the unit reverts to HOT BUS.

Location

The ADIRUs are installed in the avionics compartment.
One MFP is installed on the forward left side of the A/C, and the other two are installed on the forward right side.
Three ISPs are installed on the forward left side of the A/C, and other three are installed on the forward right side.

Three SSA probes are installed below the windshields.
There are two OAT probes, installed on the Nose Landing Gear (NLG).
The PFCS AOA probe is located on the forward left side of the A/C.

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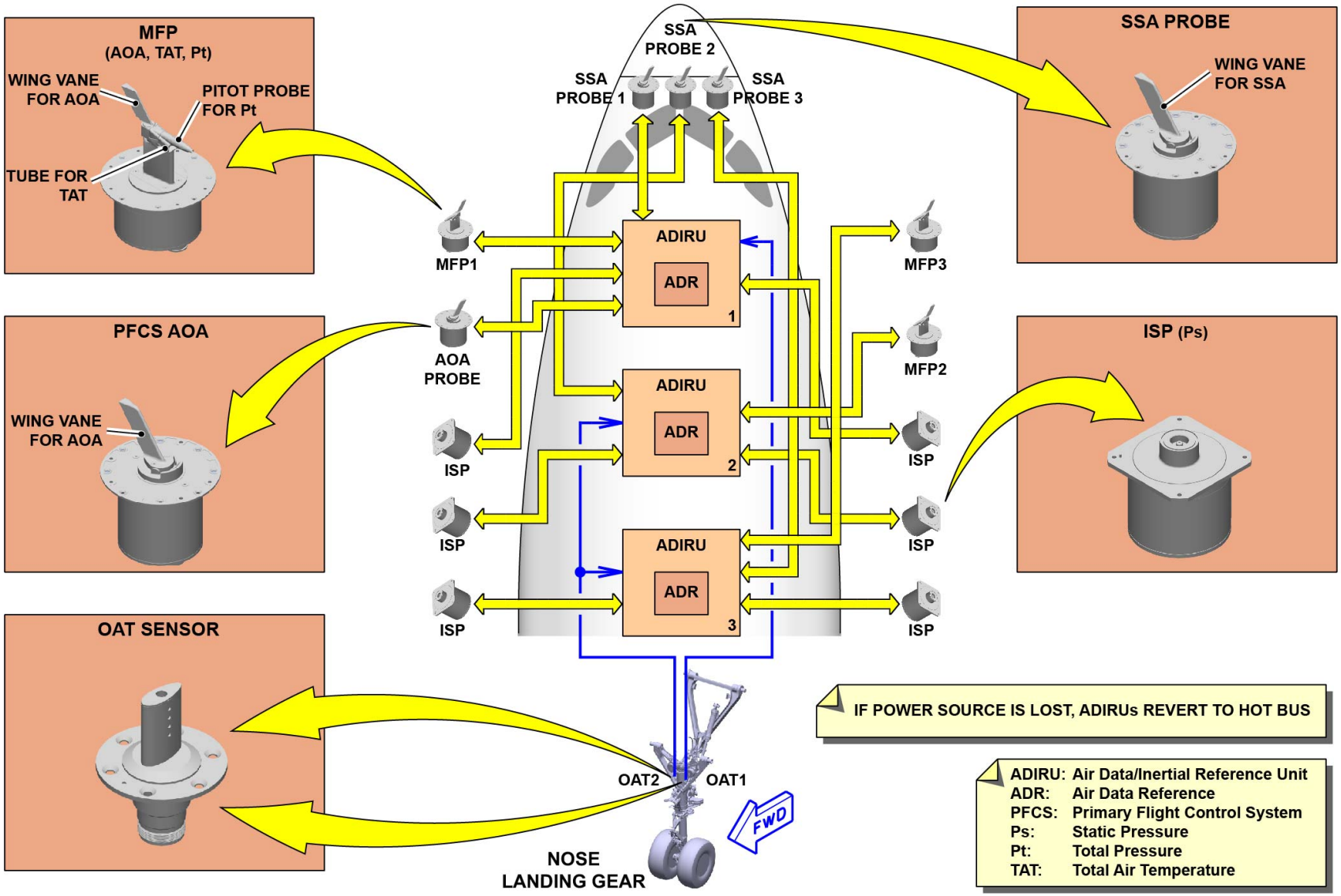

PROBES DESCRIPTION ... LOCATION

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AIR DATA AND INERTIAL REFERENCE SYSTEM DESCRIPTION (2/3)

Anti-Icing Function

The anti-icing function can be operated in:
- Automatic mode
- Manual mode (only on ground).

The anti-icing function is automatically operated when:
- At least one engine is running
- From ADIRS, when the Ground Speed (GS) is more than 30 kts or the A/C is in-flight.

The anti-icing function can be operated manually with the PROBE/WINDOW HEAT P/BSW when the A/C is on ground with no engine operating.

Computation

The primary internal functions of the ADIRUs are the ADR and IR computations.
The ADR part of the ADIRUs computes the air data and the IR part of the ADIRUs computes the inertial data which are shown on the PFDs, NDs (and Head-Up Displays (HUDs) in option). Data are transmitted through the AFDX network or in back-up, for the most critical data, through the back-up ARINC 429 bus.

ADR computation

The ADR gives the air data parameters (Calibrated Air Speed (CAS), Mach number, AOA, TAT, static temperature, etc.) to the AFDX network or in back-up with ARINC 429. The ADR part receives the data that follow:
:
- Air data from the probes digital converters.
- Baro-setting value from the Flight Control Unit (FCU) or FCU back-up hosted in CPIOMs.
- Maximum operating speed and maximum operating mach discrete input value from L/G DOWN VMO/MMO Selector (SEL) switch, used for ferry flights with landing gear down
- Switching panel for AIR DATA manual reconfigurations.

The ADR part of ADIRUs 1 and 3 gives air data to the Integrated Standby Instrument System (ISIS).

IR computation

The aim of the IR function is to give:
- The IR information, that means: navigation information (position, ground speed, velocities and accelerations along all the A/C axes, etc.)
- The attitude information (pitch angle, roll angle, pitch and roll rotation rates, pitch and roll rotation accelerations, etc.)
- The heading information (magnetic heading, true heading, yaw rotation rates, etc.).

To do this, each ADIRU calculates the gyro and the accelerometer outputs.
Each ADIRU gives the IR data to users through the AFDX network or in back-up with ARINC 429..
The IR part receives:
- The GNSS data from the MMRs through ARINC 429. The ADIRUs use the IR data and GNSS data from the MMR to calculate the GPIRS data..
- The barometric selecting data from the FCU through ARINC 429 or from the FCU back-up through the AFDX network.

The IR part of ADIRU1 and ADIRU3 sends data to the ISIS.

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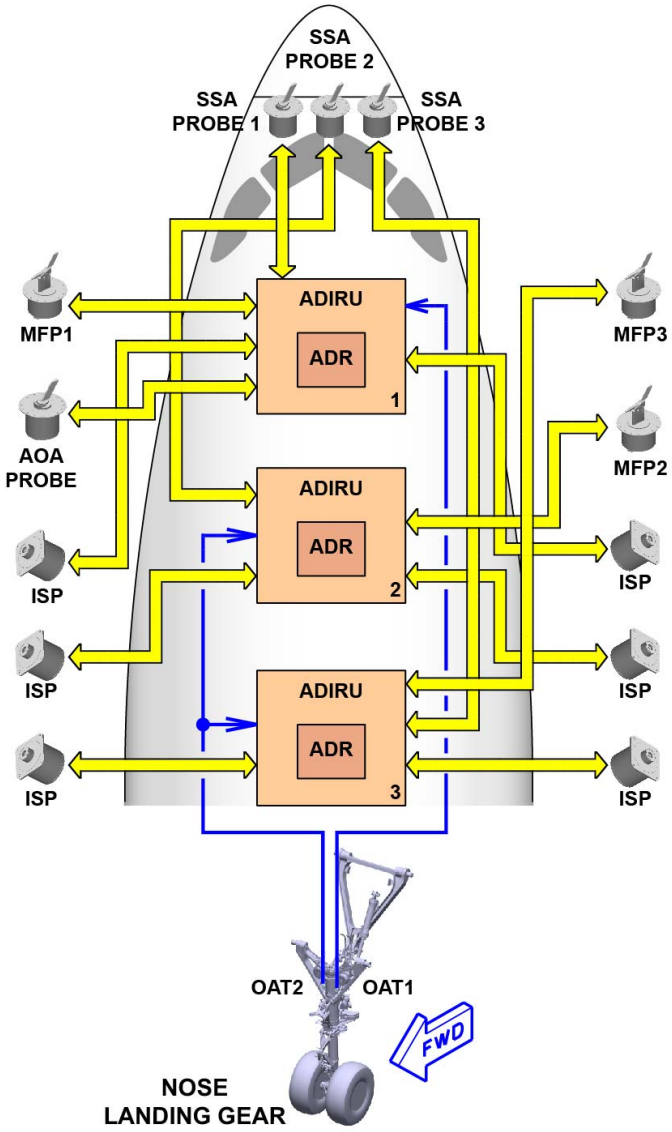

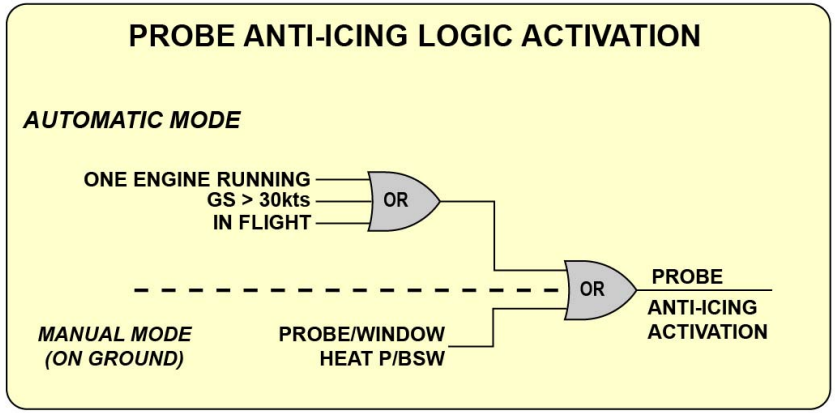

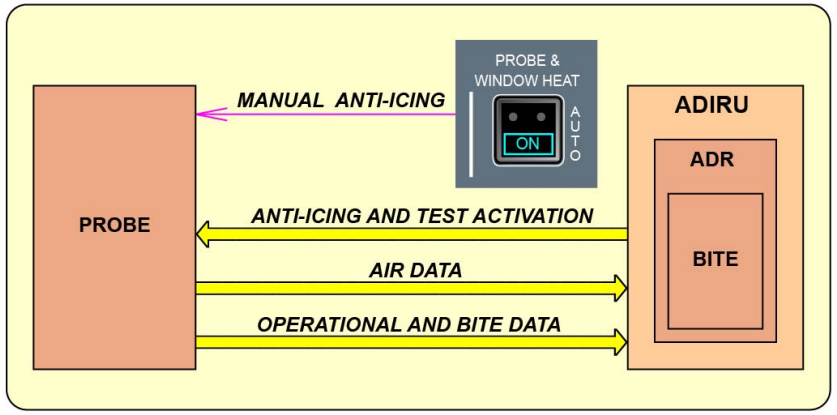

BITE: Built-In Test Equipment
GS: Ground Speed

ANTI-ICING FUNCTION & COMPUTATION

AIR DATA AND INERTIAL REFERENCE SYSTEM DESCRIPTION (2/3)

Interface

FMS to ADIRS interface
The IR part of the ADIRS can automatically align on the GNSS position that comes from the MMR.
The crew can do an IR alignment through the FMS pages shown on the MFD.
The initialization of the clock function of the ADIRU is done by GNSS data (if available) or manual entry from the FMS. The FMS sends clock parameters to the ADIRS when is updated manually by the pilot.
ADIRS to MMR interface
At power-up, the MMR needs some initialization data from the Inertial Reference System (IRS) part of the ADIRU so that the time to valid the GNSS position output can be reduced.
LGERS to ADIRS interface
The ADIRS receive data (ground/flight and gear/door status) from the LGERS:
- For the air/ground condition and gear extended status
- To correct landing gear effect on airflow for static pressure measurement.

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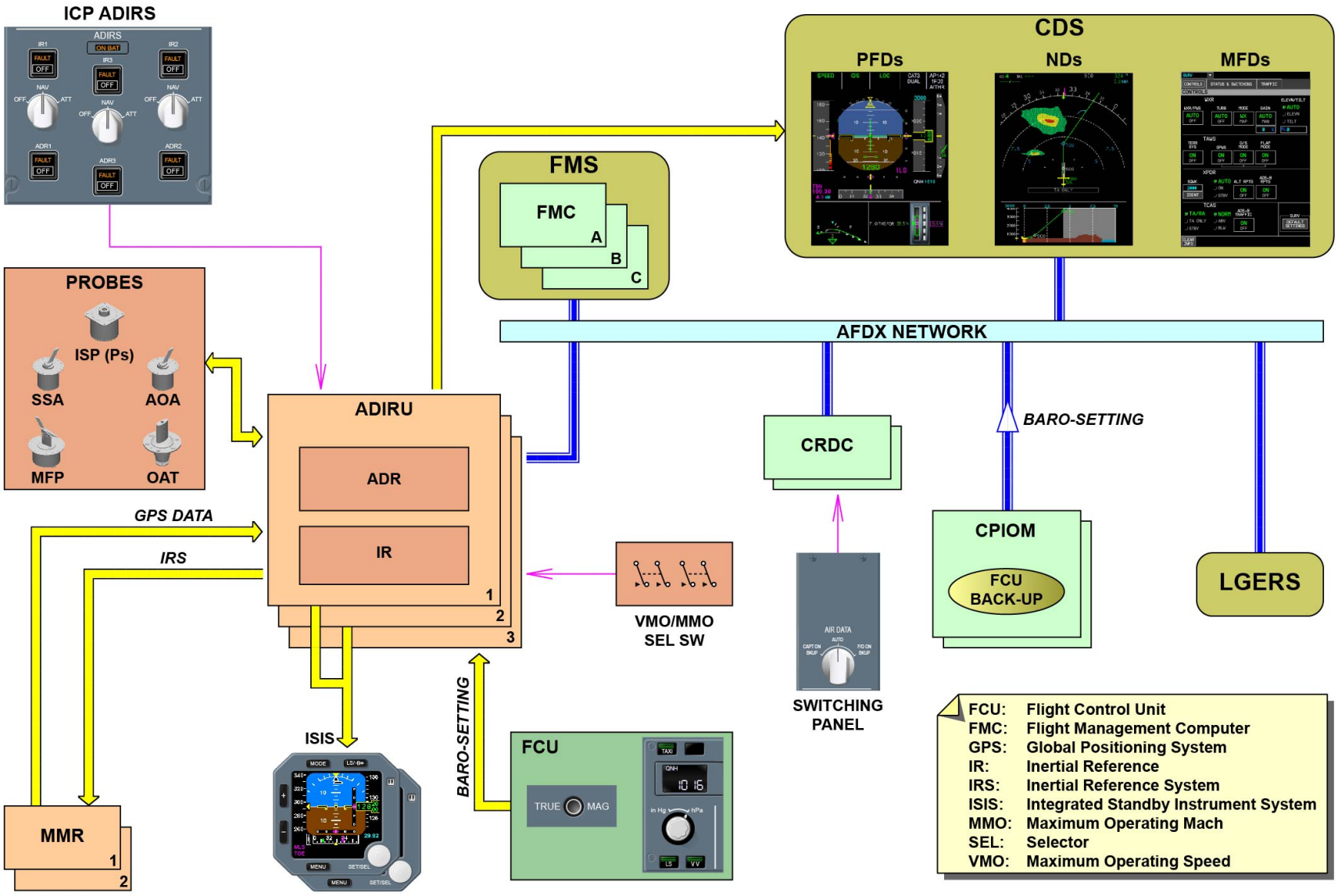

INTERFACE

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AIR DATA AND INERTIAL REFERENCE SYSTEM DESCRIPTION (2/3)

ADIRS Switching Panel

New ADIRU switching called NAIADS (New Air and Inertia Automatic Data Switching) has been introduced on A350 to enhance the flight parameters display and troubleshooting when facing UNRELIABLE AIRSPEED.
NAIADS function has three primary sub-functions:
- To provide the flight crew with a backup airspeed and altitude in case of unreliable airspeed or altitude
- To automatically display the best airspeed, altitude, inertial data without requiring flight crew action
- To maintain normal Normal law and Auto Pilot engaged using backup data once all the ADR and ISIS anemometric data are detected erroneous or failed. This third item is not part of the current issue and will be integrated later.

The ADR/IR source is automatically selected in relation to the predefined priority:
- Captain side: ADIRU1 -> ADIRU3 -> ADIRU2
- F/O side: ADIRU2 -> ADIRU3 -> ADIRU1

In addition to above priority, different cases should be taken into account according to ADR or IR functions:
- If the 3 ADR air speed are failed or rejected by the monitoring function hosted in PRIM, the ISIS data are displayed on both PFDs.
- If the 3 ADR and ISIS airspeed are rejected by the monitoring function hosted in PRIM, the backup data are displayed on both PFDs.

Note: Backup air data are computed through a mix of two different sources (independent from ADR):
- Engines CAS according to P0, P160, T20 and N1 parameters further EIF computation
- AOA (Angle Of Attack) speed based on AOA position, A/C weight and vertical load factor.
- If the 3 IR are failed or rejected by the monitoring function hosted in PRIM, the ISIS attitude is displayed on both PFDs.

A single rotary knob, dealing with AIR DATA, is installed on the switching panel (311VU) to initiate manual reconfiguration on Captain or F/O side.
When moved away from AUTO position, backup air data are displayed on related side.
It is used by the Pilots in case of UNRELIABLE AIRSPEED INDICATION to override automatic logics and for air data consistency check.

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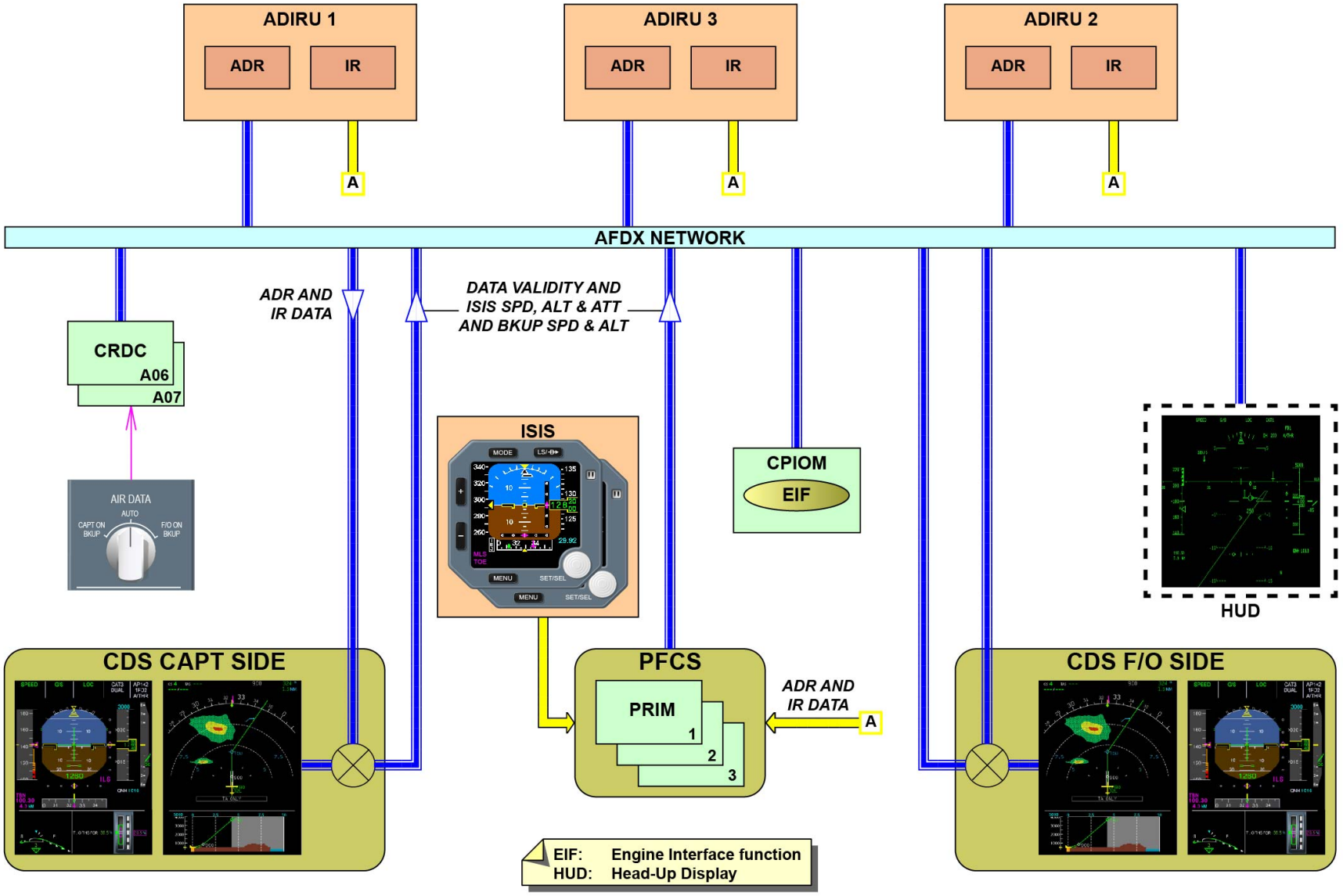

ADIRS SWITCHING PANEL

AIR DATA AND INERTIAL REFERENCE SYSTEM CONTROL AND INDICATING (2/3)

ADIRS Start Procedure (Align on GPS Position) (2)

The alignment is the initialization mode for the IR part of the ADIRU. Its primary function is to initialize the attitude, velocity and position integration functions implemented in the navigation mode. This mode operates on ground only with a motionless condition.
Normal Alignment is automatically selected when ADIRU switches from OFF to NAV mode.
In this mode, the ADIRU performs a gyrocompass alignment. During this phase the ADIRU determines roll and pitch mainly using accelerometers measurement. The duration of alignment is a function of latitude. Alignment time is from 4.5 minutes to 17 minutes.
During alignment process, the ADIRU provides an alignment status and a time counter that indicates the remaining time to reach a sufficient attitude and heading accuracy to ensure nominal navigation performances (Time until NAV Mode). The remaining time is based on self estimated latitude or inserted latitude.
When alignment time is elapsed, the ADIRU switches automatically to Navigation mode provided a valid initial position is available; otherwise the ADIRU remains in Alignment mode.
The initial position can be either manually inserted or GPS selected. GPS position is selected if it is available and valid (i.e. no RAIM alarm) at the beginning of alignment sequence.
When initial position is received GPS, the ADIRU performs a consistency test between inserted latitude and self-computed latitude.
In case one position test fails, the ADIRU sends a corresponding message to the navigation system and remains in alignment mode until a consistent acknowledge command is received.
The alignment phase is not disrupted by normal aircraft operation such as refueling, loading or unloading.
Nevertheless, alignment phase, aircraft motion is monitored in order to suspend the alignment process in case of excessive aircraft motion (due for instance to wind buffeting).
Excessive motion detection test is based on accelerometer and rate gyro measurement. The alignment phase resumes as soon as the excessive motion stops.
At the end of the alignment process the ADIRU enters automatically in Nav mode.

ADIRS Start Procedure (Align on Alternative Position) (2)

At the beginning of alignment sequence the initialization process requires an initial position. If the GPS position is not available, then a manual input is required.
When initial position is entered, the ADIRU performs a consistency test between inserted latitude and self-computed latitude.
In case one position test fails, the ADIRU sends a corresponding message to the navigation system and remains in alignment mode until a consistent acknowledge command is received.
At the end of the alignment process the ADIRU enters automatically in Nav mode.

Probe Heating Activation (2)

Automatic deice function: Each ADIRU can activate the heating of its own probes (four by ADIRU) on engine running or ground-speed condition.
Manual deice function: A push button located in the low center of the overhead integrated control panel allows the pilots to activate probes heating manually. In this case, all probes are deiced in the same time.

ADIRS VMO/MMO Operation (3)

The Maximum Operating Speed/Maximum Operating Mach (Vmo/Mmo) switch position used to define the new Vmo/Mmo value.
This SW is used for ferry flights with landing gear down. It is located on the lower part of the main avionics bay.

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NAIADS Operation (3)

New ADIRU switching called NAIADS (New Air and Inertia Automatic Data Switching) has been introduced on A350 to enhance the flight parameters display and troubleshooting when facing UNRELIABLE AIRSPEED.
CDS (Control and Display System) choose the source to display according to:
- The self-validity of the data
- The validity provided by the PRIM monitoring

The ADR/IR source is automatically selected according to predefined priority:
- Captain side: ADIRU 1 ADIRU 3 ADIRU 2 ISIS Back up
- F/O side: ADIRU 2 ADIRU 3 ADIRU 1 ISIS Back up

Backup data are computed through a mix of two different sources (Independent from ADR):
- Engines CAS according to P0, P160, T20 and N1 parameters further EIF computation,
- AoA (Angle of Attack) speed based on AoA position, A/C weight and vertical load factor.

A single rotary knob, dealing with AIR DATA, is installed on switching panel (311VU) to initiate manual reconfiguration on Captain or F/O side.

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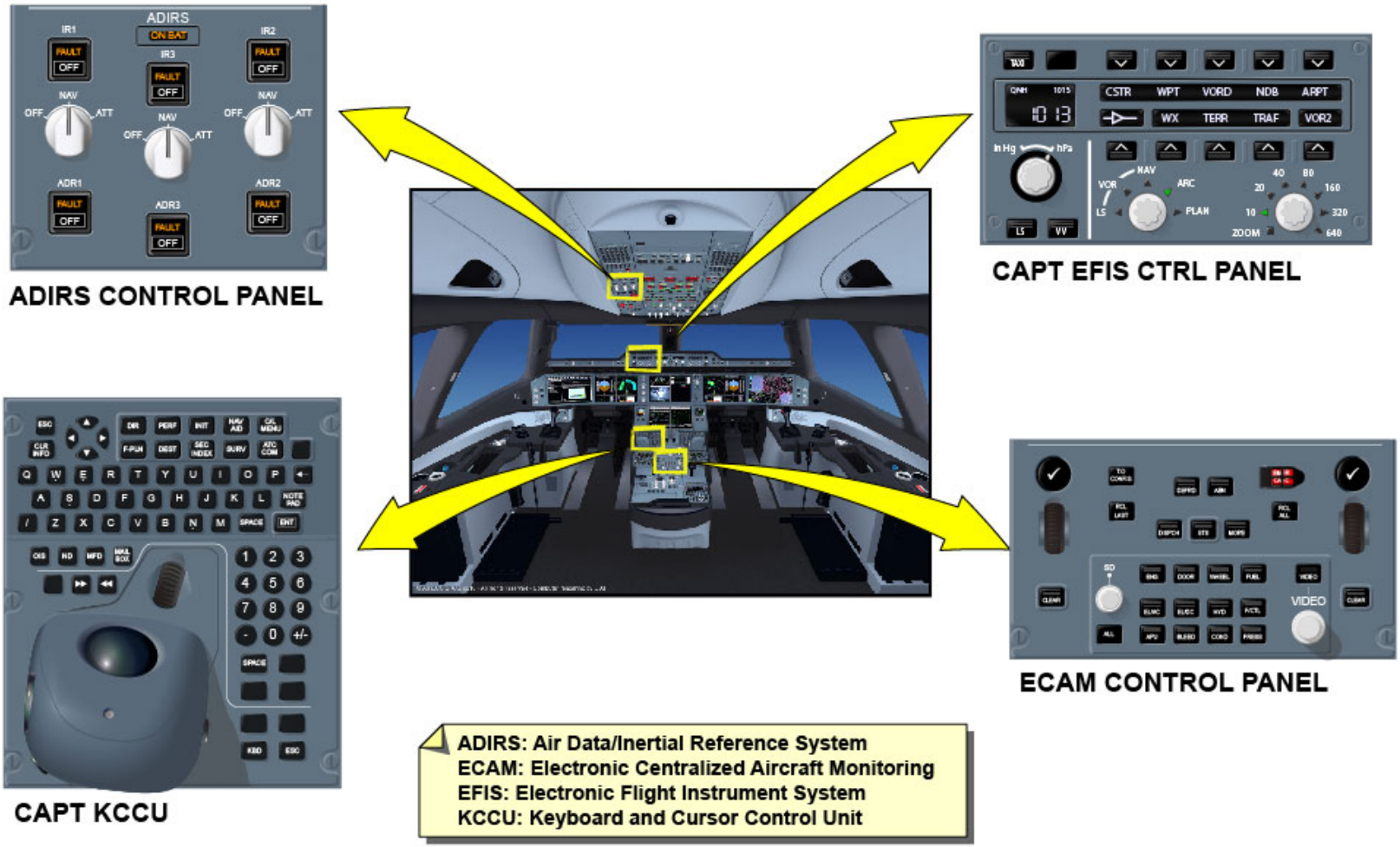
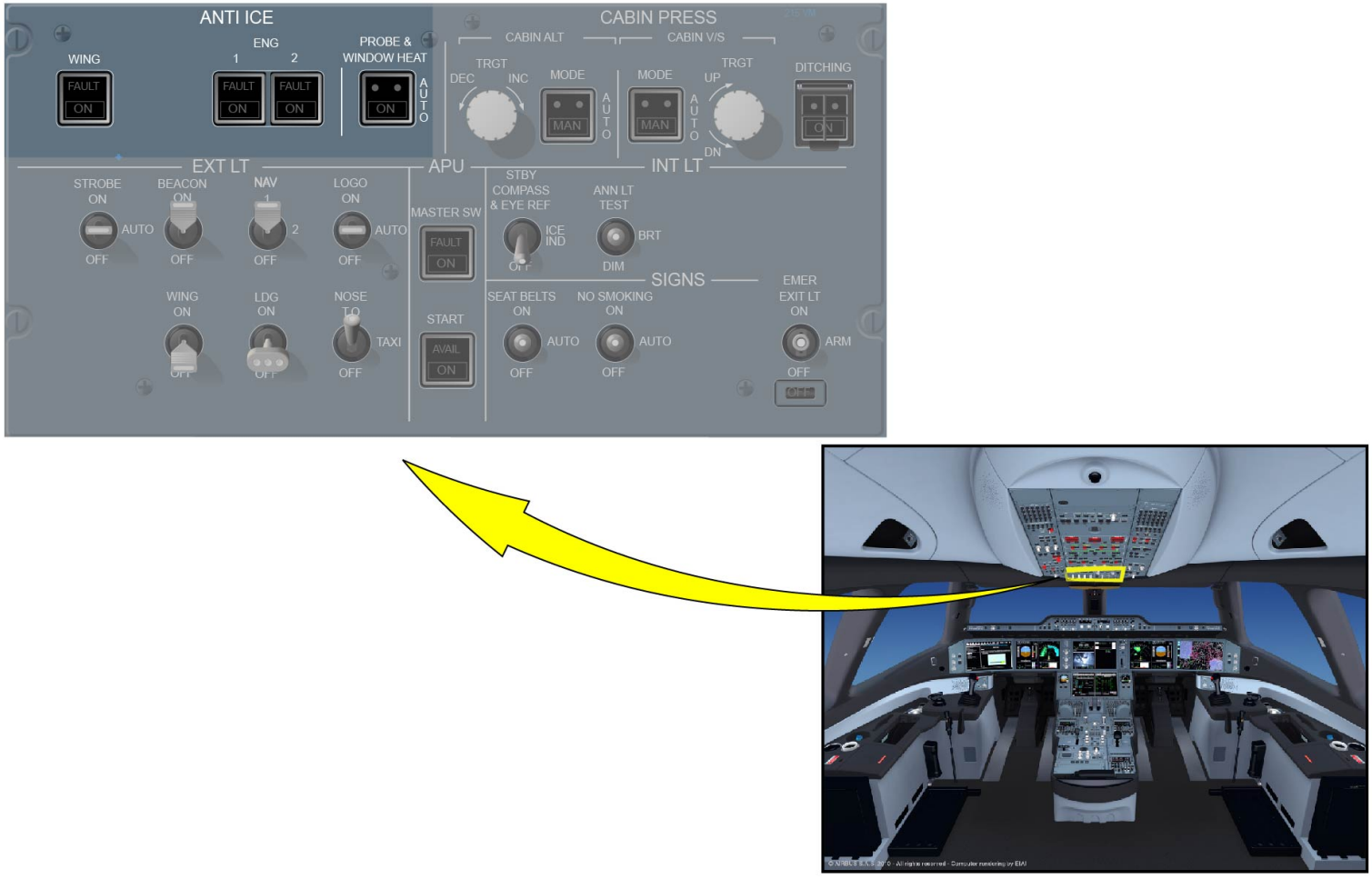


ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)



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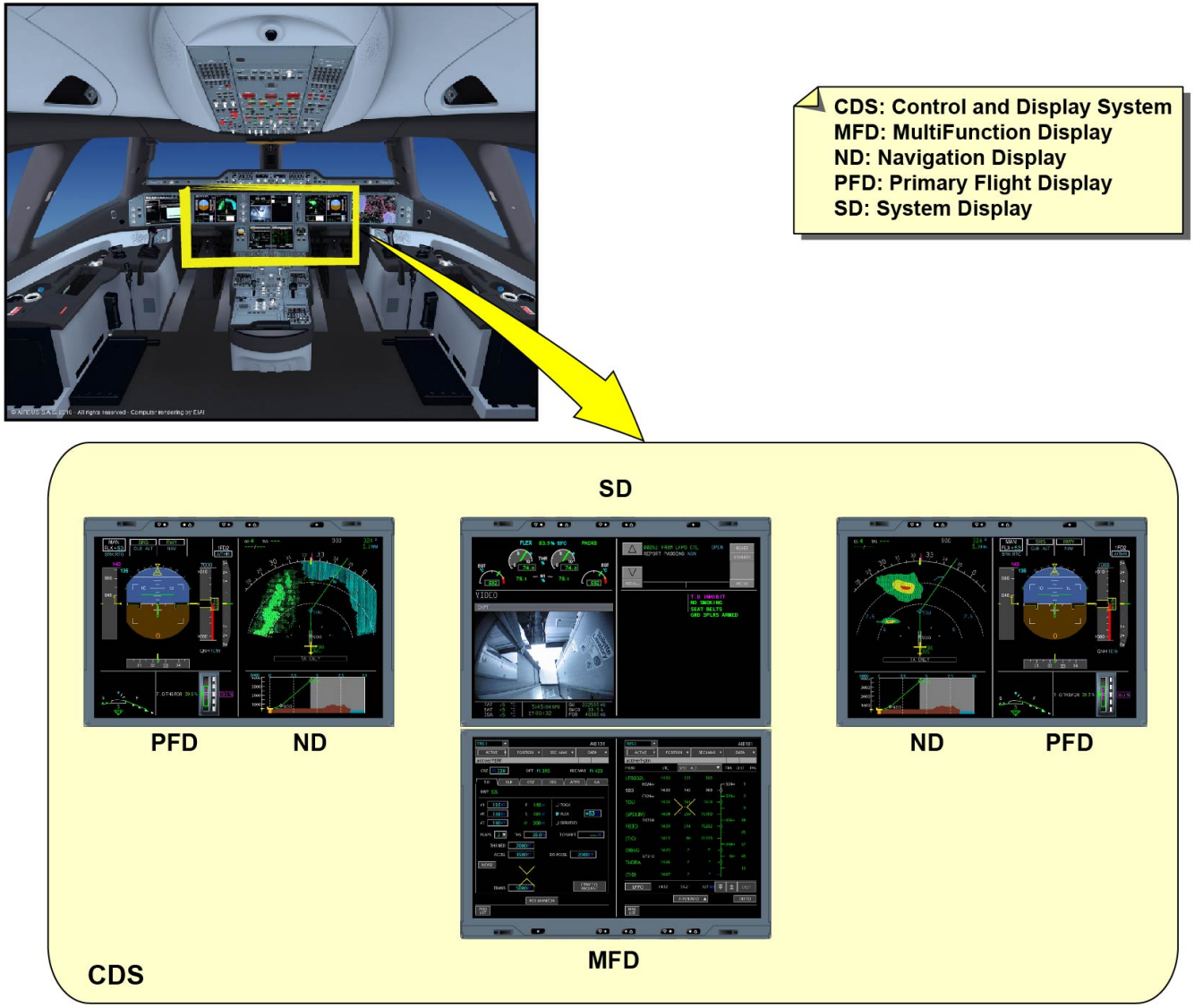
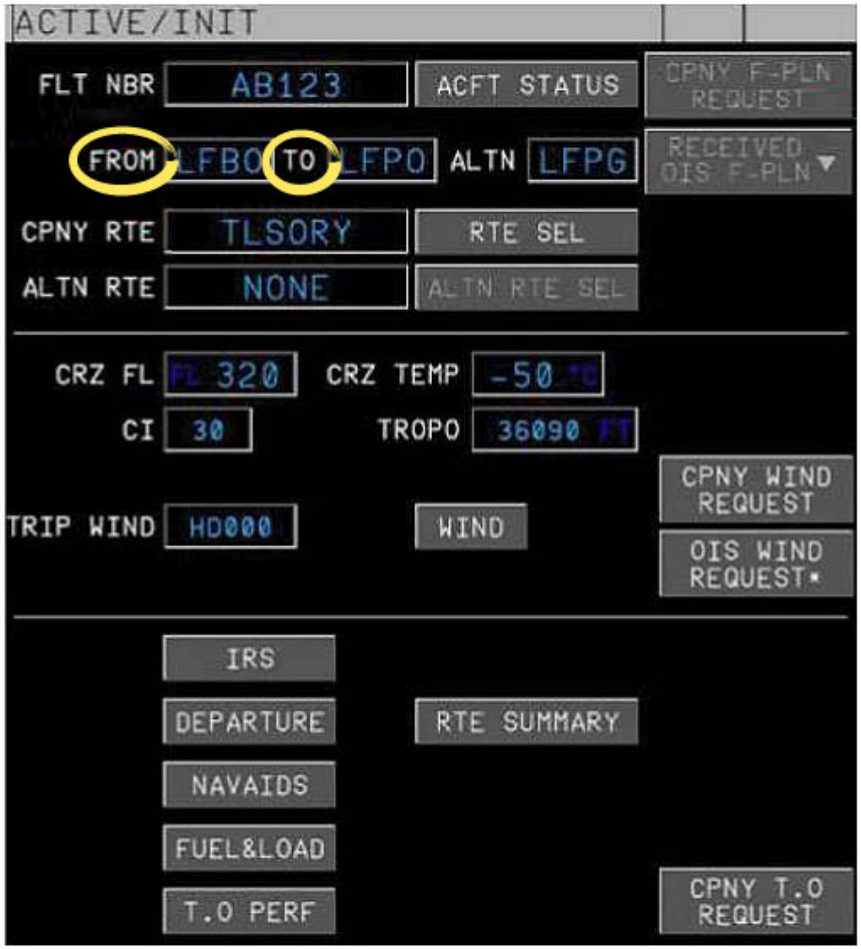
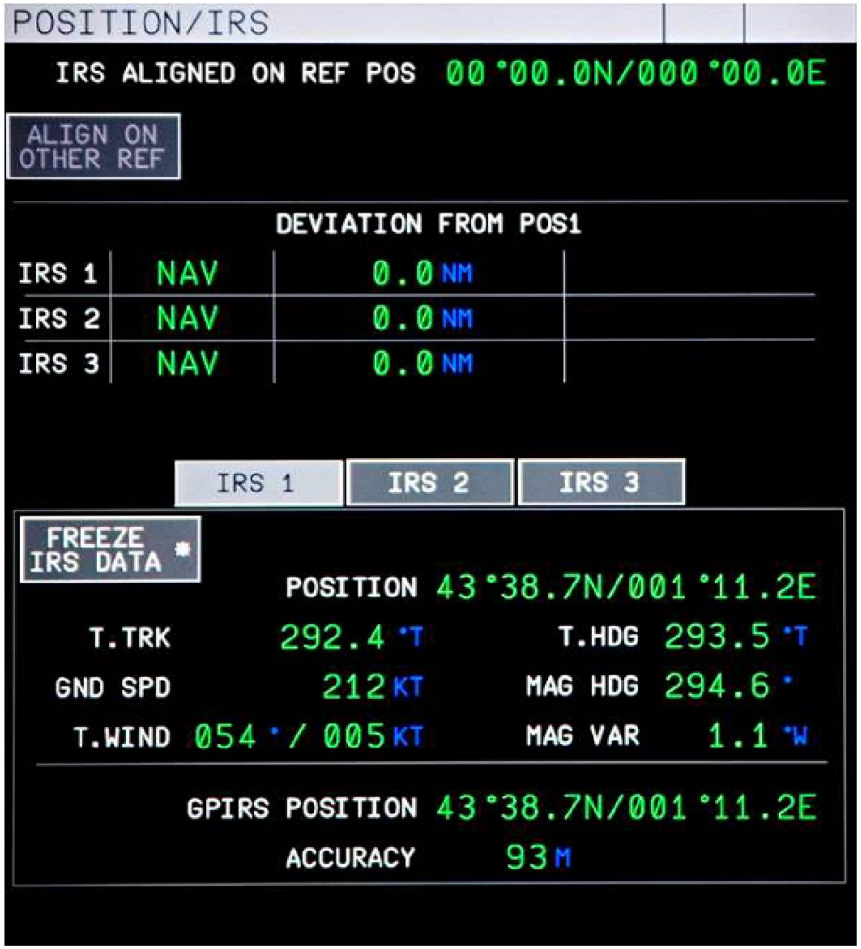


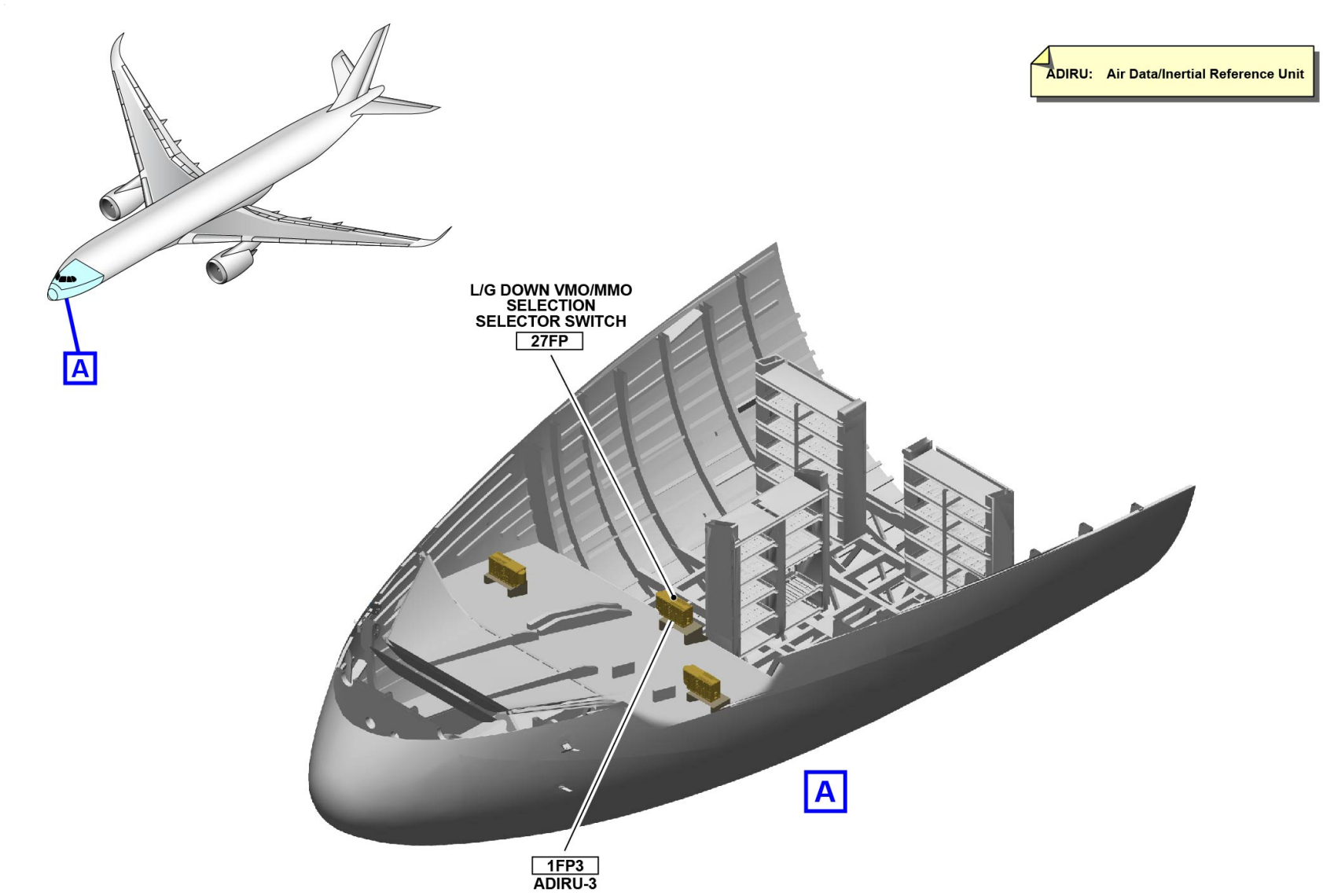
ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)



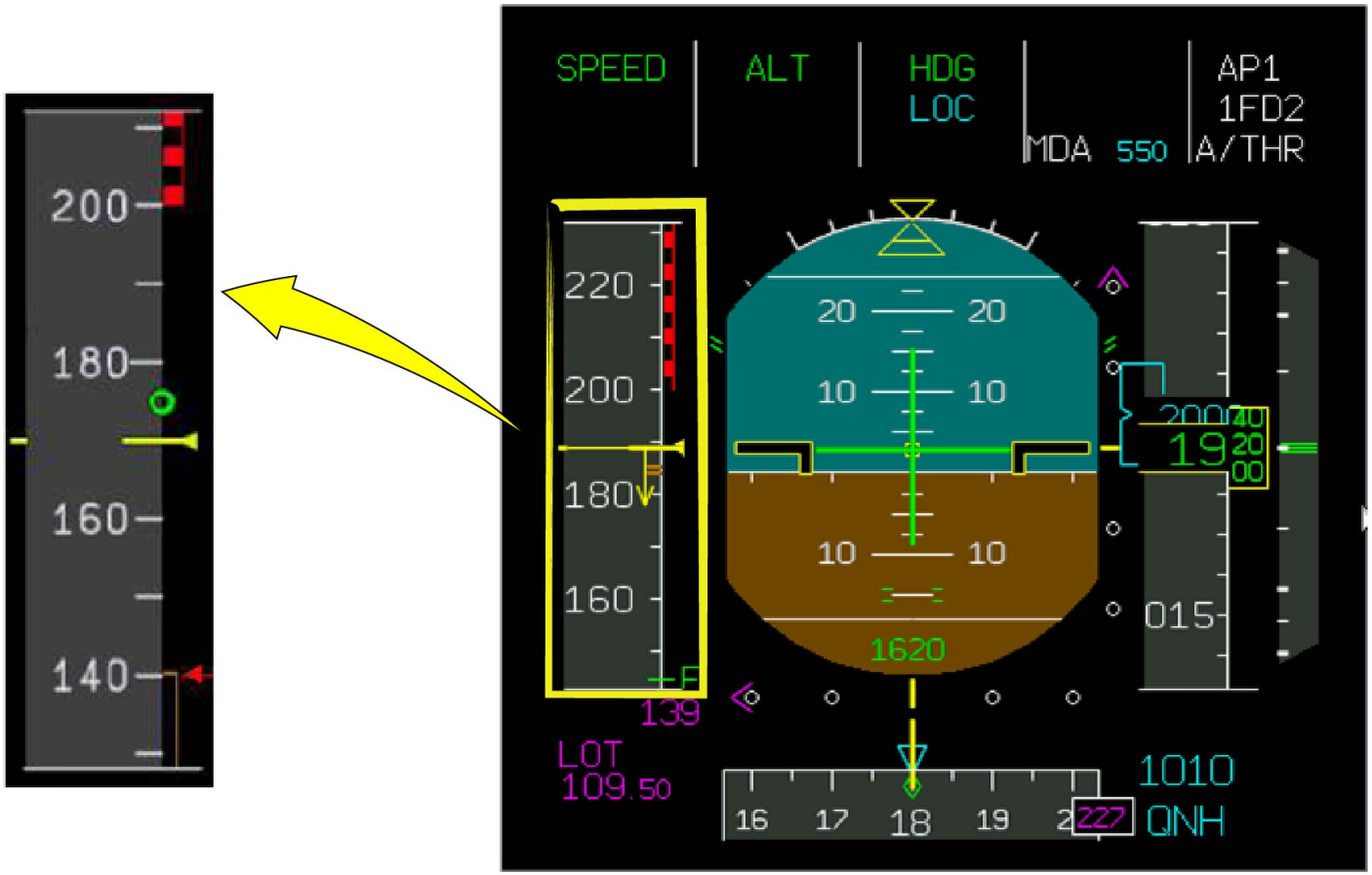
ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)



ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)

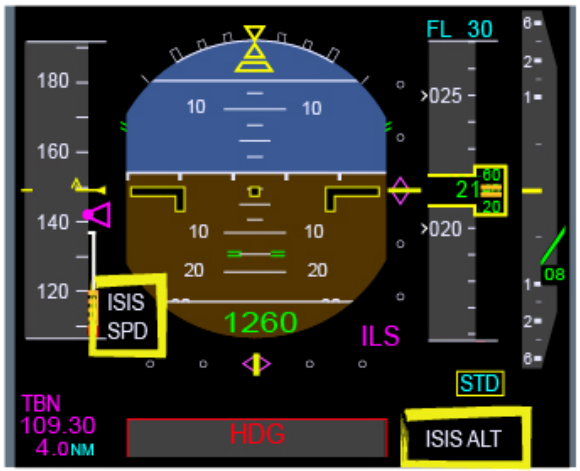


ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)



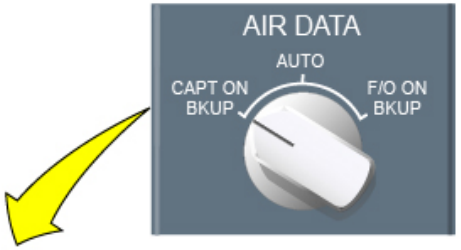
ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)

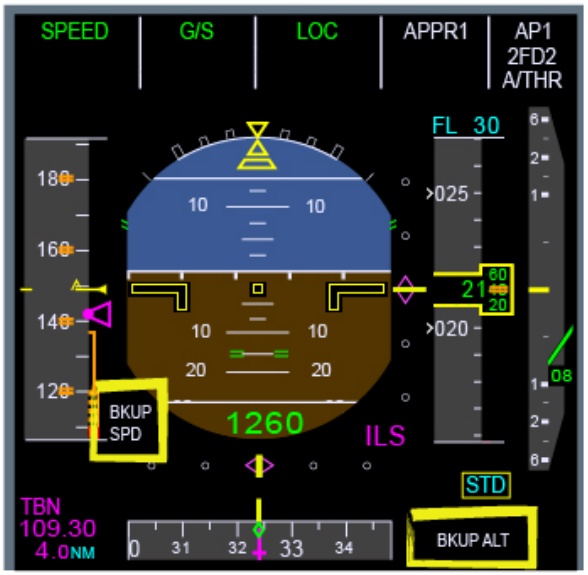
ISIS DATA AUTOMATIC DISPLAY



Same result on F/O side when AIR DATA knob set to F/O ON BKUP

MANUAL BKUP SELECTION





CAPT PFD

F/O PFD

ADIRS START PROCEDURE (ALIGN ON GPS POSITION) (2) ... NAIADS OPERATION (3)

STANDBY NAVIGATION SYSTEM DESCRIPTION (2/3)

General

The standby navigation system (Integrated Standby Instrument System (ISIS) and standby magnetic compass) is the back-up system if there is a failure in the Air Data/Inertial Reference System (ADIRS), CDS or AFDX network.
The ISIS units compute the air data (with the standby probes) and the attitude data (with the internal gyrometers and accelerometers).
The standby navigation system has:
- One standby magnetic compass, installed on the top of the windshield center part
- One ISIS unit (RH ISIS unit is optional), installed at the center of the main instrument panel
- One standby pitot probe, installed on the left FWD fuselage, which gives the total pressure to the ISIS
- Two standby static probes, installed on the left and right FWD fuselage, which give the static pressure to the ISIS.

The standby probes are pneumatics. They are connected to the ISIS units with pneumatic lines.
In default configuration, each ISIS can do all the functions of either the standby flight display or standby navigation display.
The ISIS1 shows the standby flight display and the ISIS2 shows the standby navigation display.
In dual configuration, if there is an ISIS1 failure, the ISIS2 configuration is automatically changed in standby flight display mode. In this configuration, it is possible to recover the standby navigation display mode again with the MODE P/BSW, at the front face of the ISIS unit.
If there is an ISIS2 failure, the ISIS1 stays in standby flight display mode.

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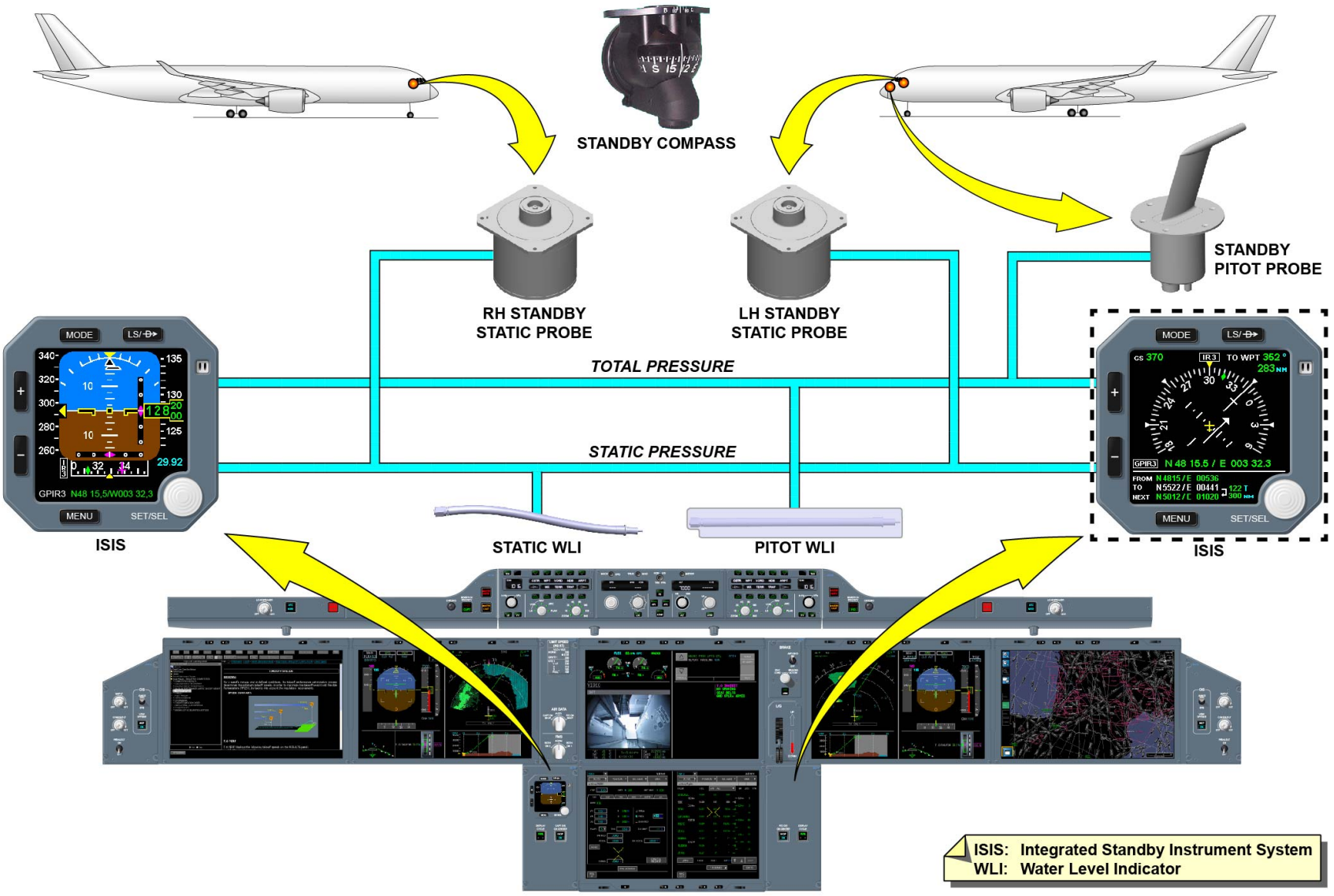

STANDBY COMPASS
RH STANDBY STATIC PROBE
LH STANDBY STATIC PROBE
STANDBY PITOT PROBE
TOTAL PRESSURE
STATIC PRESSURE
STATIC WLI
PITOT WLI
ISIS
ISIS
MODE
LS/
MENU
SET/SEL
ISIS: Integrated Standby Instrument System
WLI: Water Level Indicator

GENERAL

STANDBY NAVIGATION SYSTEM DESCRIPTION (2/3)

Standby Navigation System Interfaces

Interface between the two ISIS (dual configuration)

In the dual configuration installation, the two ISIS units transmit status through discrete links. These links do an automatic reconfiguration between the two ISIS if there is a failure.

Probes

For de-icing function the standby probes are supplied with 115VAC.
The discrete link between the ISIS and the probes are used for:
- De-icing in-flight
- Probes test activation
- Probe failure indication.

Note: the Air Data/Inertial Reference Unit (ADIRU) 1 or 3 activates though the discrete link of the ISIS indicators this discrete link in the conditions that follow:
- One engine is running, or
- The Ground Speed (GS) is more than 30 kts, or
- From the ISIS, when the Calibrated Air Speed (CAS) is more than 50 kts.

The PROBE/WINDOW HEAT P/BSW on overhead panel can be used to select the de-icing function manually.

ADIRUs

Each ISIS indicator receives the Inertial Reference (IR) data from the ADIRU1 and ADIRU3.
The ISIS indicator shows the data that come from the ADIRU3. If there is an ADIRU3 failure, the ISIS indicator shows the ADIRU1 data.
The ISIS receives the information that follows: heading (magnetic and true), track (true), ground speed, latitude, longitude and engine running.
The ISIS sends data (static pressure (Ps), total pressure (Pt), mach number, CAS, probe heater status) to the ADIRUs 1, 2 and 3 through the CRDC on the AFDX network.

Multi-Mode Receiver (MMR)

Each ISIS unit has an interface with the MMR1 through an Aeronautical Radio Incorporated (ARINC) 429 bus. The MMR1 sends the Landing System (LS) data (Localizer (LOC) and GLIDE deviations) and the Global Navigation Satellite System (GNSS) data (GS, latitude, longitude and true track).

Cabin Pressure Control System (CPCS)

Each ISIS unit has an interface with the CPCS through an ARINC 429 bus to give the static pressure.

Flight Control Unit (FCU) and FCU back-up

Each ISIS has an interface with the FCU and with FCU back-up through the AFDX hosted in the CPIOMs. These interfaces receive the magnetic/true heading selection data.

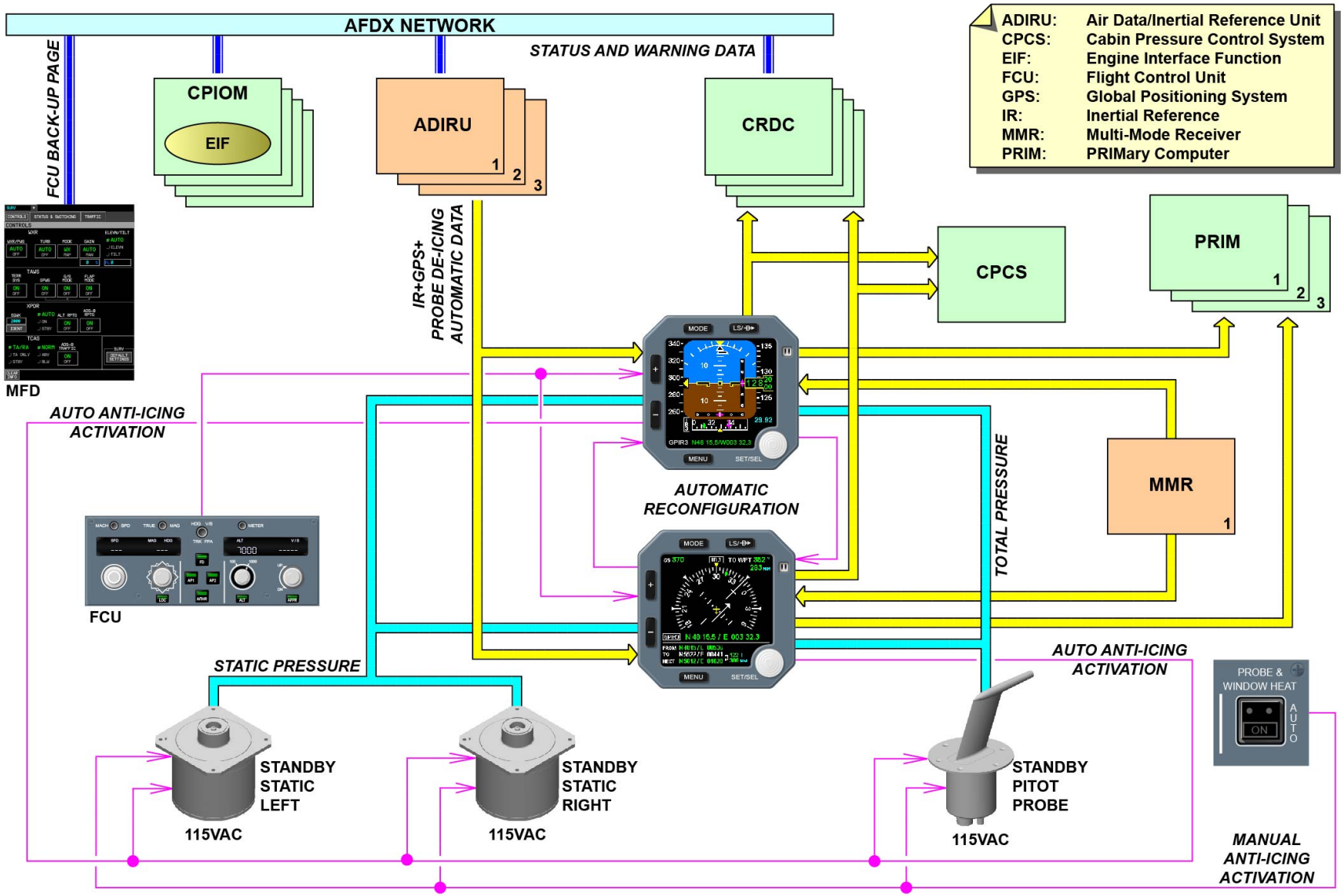
PRIMary Computers (PRIMs)

There is a link between the ISIS and the three PRIMs through ARINC 429 bus. This interface is used to send air data and inertial data to the PRIMs if there is an ADIRS failure. The use of ISIS aims to increase availability of needed sources for Flight Guidance (FG) and Flight Envelope (FE) functions.

Propulsion Control System (PCS)

The ISIS is interfaced with the four Engine Interface Function (EIF) (two per engine). These four EIF are installed in four different CPIOMs. The EIF is in charge of the engine air data selection.

V2414251 - V00T0MM0 - VM34D2SNS003001



STANDBY NAVIGATION SYSTEM INTERFACES - INTERFACE BETWEEN THE TWO ISIS (DUAL CONFIGURATION) ... PROPULSION CONTROL SYSTEM (PCS)

STANDBY NAVIGATION SYSTEM CONTROL AND INDICATING (2/3)

Integrated Standby Instrument System (ISIS) (2/3)

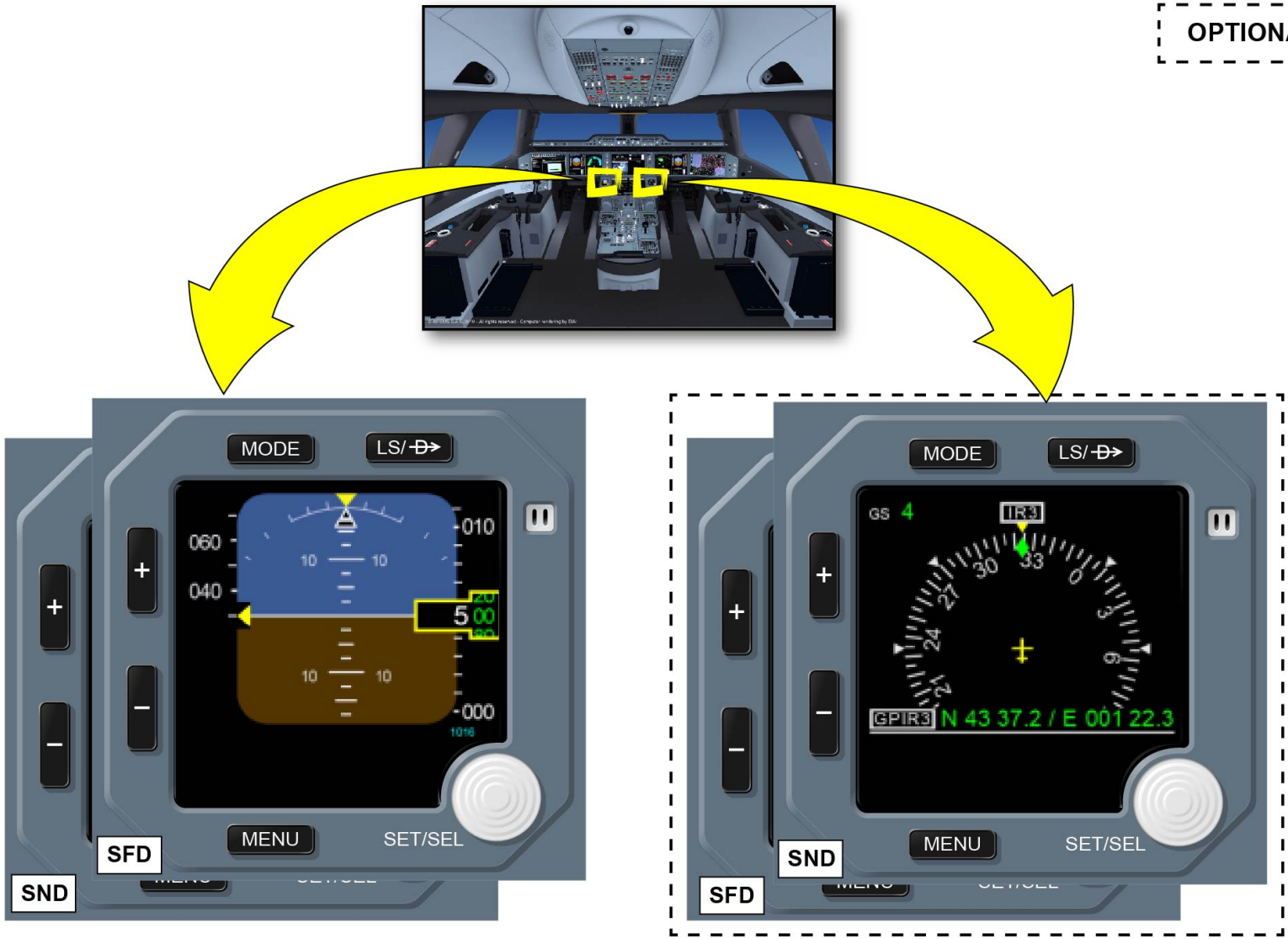
Normal mode:
The system displays only one Secondary Flight Display (SFD) and one Secondary Navigation Display (SND) mode at the same time.
A manual reconfiguration is possible as long as any screen has failed, if a screen has failed, no manual reconfiguration is possible anymore.
Using the manual reconfiguration, if ISIS-1 is switched off or turned to SND mode, ISIS-2 will be automatically reconfigured in SFD mode.
If ISIS-2 is switched off, ISIS-1 stays in SFD mode.
Degraded mode:
If ISIS-1 has been switched off or turned to SND mode prior to ISIS-2 failure (that was displaying FD information), ISIS-1 will be automatically reconfigured in SFD mode.
If ISIS-2 has been switched off prior to ISIS-1 failure, ISIS-2 will be automatically reconfigured in SFD mode.
The front face of each ISIS is equipped with six buttons:
- One MODE push-button enables the manual reconfiguration.
- One LS/Dir To push-button is used to activate landing information in SFD mode, and to activate navigation in SND mode.
- One MENU push-button enables to enter or exit from the different sub-menu items. The pushbutton MENU enables to reset ISIS in certain configuration (Excessive motion, Power on Limit).

SET SPD BUG1
SET SPD BUG2
SET ALT BUG
DISPLAY METERS
SET BARO UNIT
DISPLAY NAV
DISPLAY FIX
MAINTENANCE (displayed only on ground)
The MAINTENANCE item enables the pilot to access to maintenance menus.

TESTS page
AIR DATA TESTING
- One SET/SEL push/turn button enables to set a change the bare/standard pressure and to set/select the items in the menu.
- Two brightness push-buttons (+/-) enable to set the brightness.

V2414251 - V00T0MM0 - VM3412SNS003001

OPTIONAL



INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS) (2/3)

MAINTENANCE MENU

BORESIGHTING RESULT

AIR DATA TESTING IN PROGRESS

INTEGRATED STANDBY INSTRUMENT SYSTEM (ISIS) (2/3)

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V2414251 - V00T0MM0 - VM34I2SNS003001

MULTI-MODE RECEIVER (MMR) DESCRIPTION (2/3)

General

The MMR system has the following functions:
- The Global Navigation Satellite System (GNSS) for navigation function support
- The Landing System (LS).

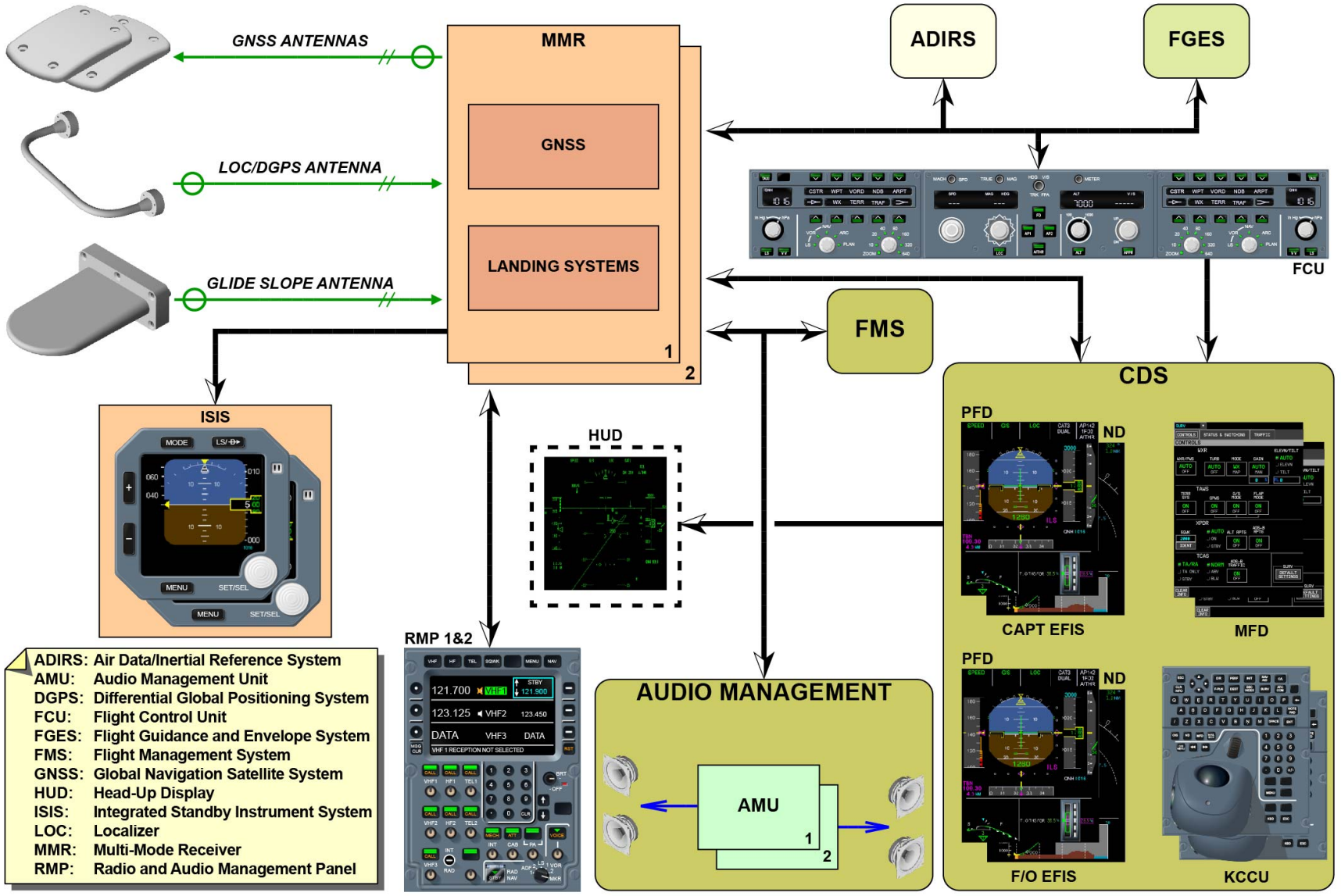
The GNSS is a worldwide satellite navigation system. The GNSS principle is to receive and process the navigation satellite signals (from the Global Positioning System (GPS) constellation for example) and then to determine for the A/C:
- The altitude
- The position
- The ground speed
- The time (Universal Time Coordinated (UTC)).

These parameters are also called PVT (Position/Velocity/Time).
The LS function gives the lateral and vertical deviation orders for final approach and landing to the flight crew and A/C systems.
Two MMR computers receive information from the different antennas (Glide/Slope (G/S) antenna, Localizer (LOC)/Digital Global Positioning System (DGPS) antenna, GNSS antennas), the Flight Management System (FMS) and the different control panels such as the Radio and Audio Management Panels (RMPs), Flight Control Unit (FCU) and KCCUs.
The data computed by the GNSS and LS can be shown on:
- The display units of the CDS
- The Integrated Standby Instrument System (ISIS)
- The optional Head-Up Display (HUD).

These data are used by A/C systems such as:
- The Flight Guidance and Envelope System (FGES) function during final approach and landing
- The Air Data and Inertial Reference System (ADIRS) for consolidated A/C position computation and for the Inertial Reference (IR) alignment procedure with the GPS.

The Audio Management System (AMS) allows the listening of the audio signals from the landing ground stations.

V2414251 - V00T0MM0 - VM34D3MMR003001


GNSS ANTENNAS
LOC/DGPS ANTENNA
GLIDE SLOPE ANTENNA
MMR
GNSS
LANDING SYSTEMS
1
2
ADIRS
FGES
FCU
FMS
CDS
PFD
ND
CAPT EFIS
MFD
F/O EFIS
KCCU
ISIS
MODE
LS/
MENU
SET/SEL
HUD
RMP 1&2
AUDIO MANAGEMENT
AMU
ADIRS: Air Data/Inertial Reference System
AMU: Audio Management Unit
DGPS: Differential Global Positioning System
FCU: Flight Control Unit
FGES: Flight Guidance and Envelope System
FMS: Flight Management System
GNSS: Global Navigation Satellite System
HUD: Head-Up Display
ISIS: Integrated Standby Instrument System
LOC: Localizer
MMR: Multi-Mode Receiver
RMP: Radio and Audio Management Panel

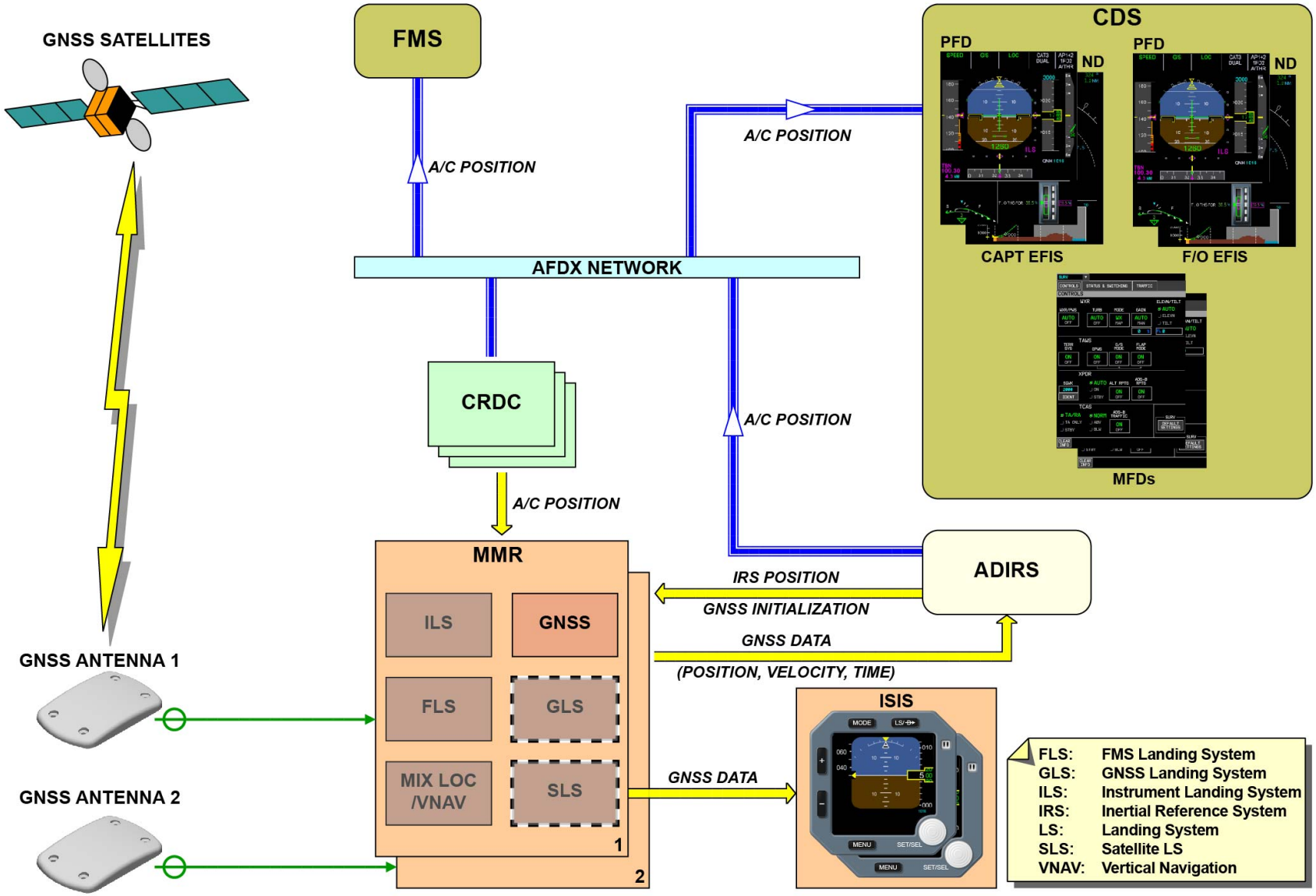
GENERAL

MULTI-MODE RECEIVER (MMR) DESCRIPTION (2/3)

GNSS Function Description

The GNSS principle is to receive the satellite navigation signals (from the GPS for example) and then to calculate the GNSS aircraft position, velocity (ground speed) and time (UTC).
The MMRs receive the satellite navigation data and signals through two GNSS antennas. The GNSS antenna 1 is connected to MMR1 and the GNSS antenna 2 is connected to the MMR2 through the coaxial cables.
For initialization purpose and GNSS position validation, the MMRs receive the last valid A/C position from the ADIRS through the A 429 bus. Once initialized, each MMR sends the GNSS calculated data (GNSS A/C position, etc.) through the ARINC 429 to each Air Data/Inertial Reference Unit (ADIRU). This data is used by the ADIRUs to do an automatic alignment of the Inertial Reference System (IRS).
Then, each ADIRU uses the GNSS data to compute the hybrid A/C position (by processing the GNSS, IRS and radio navigation A/C position data) that is used by A/C systems such as the FMS, Aircraft Environment Surveillance System (AESS) and CDS.
The ADIRUs A/C position (hybrid position) is sent to the A/C systems through the AFDX network.
Note: this ADIRU A/C position is sent back to the MMR computers, which use it as the A/C position reference for the landing systems.
The MMR1 also sends the GNSS data (true track angle, ground speed, A/C position) to the ISIS through ARINC 429 buses. The MMR2 is not interfaced with the ISIS.

V2414251 - V00T0MM0 - VM34D3MMR003001



GNSS FUNCTION DESCRIPTION

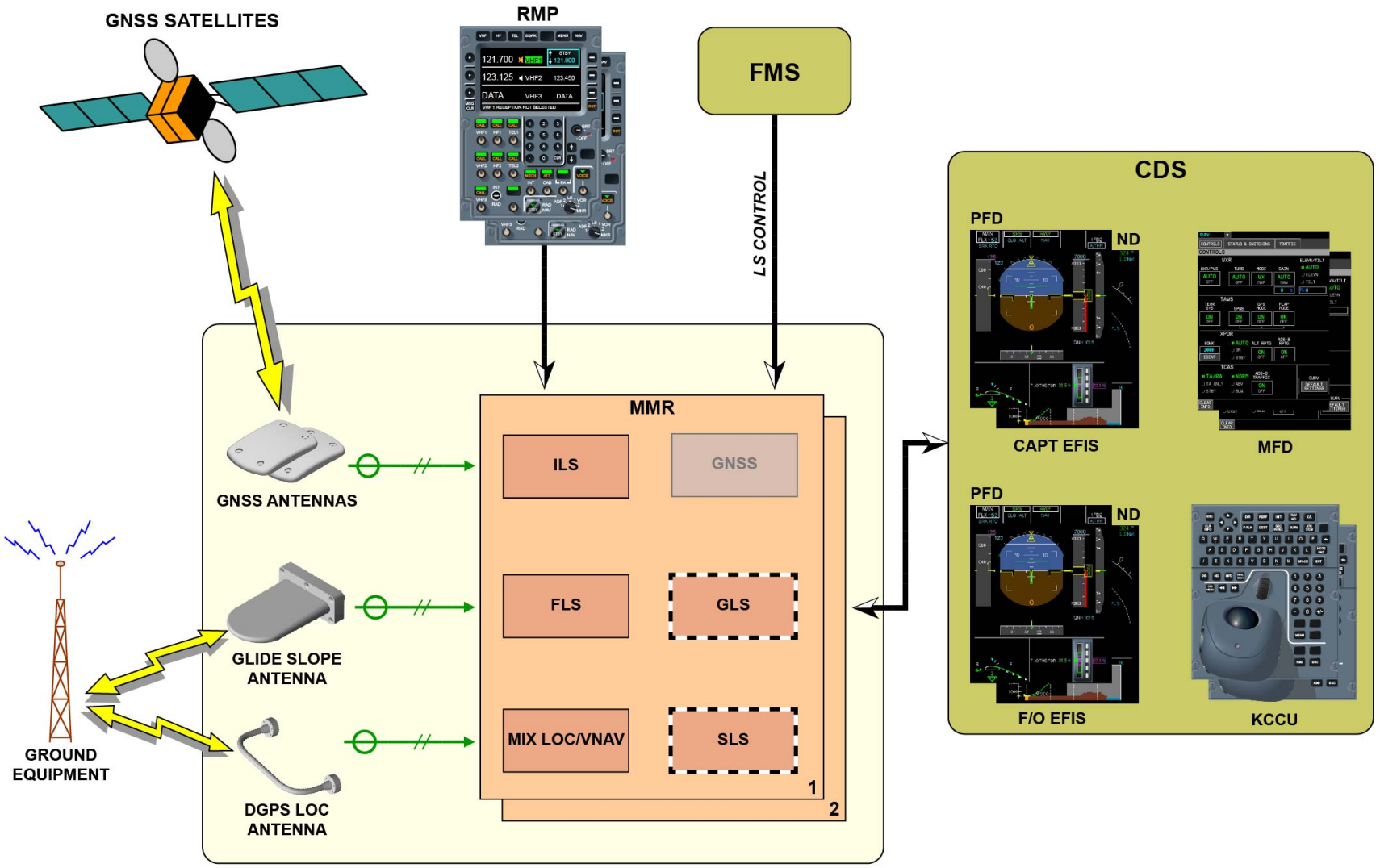
MULTI-MODE RECEIVER (MMR) DESCRIPTION (2/3)

LS Function Description

The landing functions give the flight-path deviation guidance to A/C systems during approach and landing phases. The landing functions are:
- Instrument Landing System (ILS) function
- FMS Landing System (FLS) function
- Combined ILS/FLS function: (mixed LOC/vertical NAV function)
- GNSS Landing System (GLS) function (optional)
- Satellite landing system function (optional).

For its landing functions, the MMRs:
- Receive Radio Frequency (RF) signals from the GNSS, DGPS LOC and glide capture antennas through a coaxial cable to calculate navigation data and lateral and vertical deviations.
- Receive approach data (selected landing mode, ground frequency and course) from the FMS or from the RMPs.
- Receive the last valid IRS position and the current A/C attitude and speed from the IR parts of the ADIRS for the GNSS position validation.
- Receive a test/tune inhibit discrete signal from the PRIMary Computers (PRIMs) to keep the landing mode and frequency/channel below 700ft.

V2414251 - V00T0MM0 - VM34D3MMR003001



LS FUNCTION DESCRIPTION

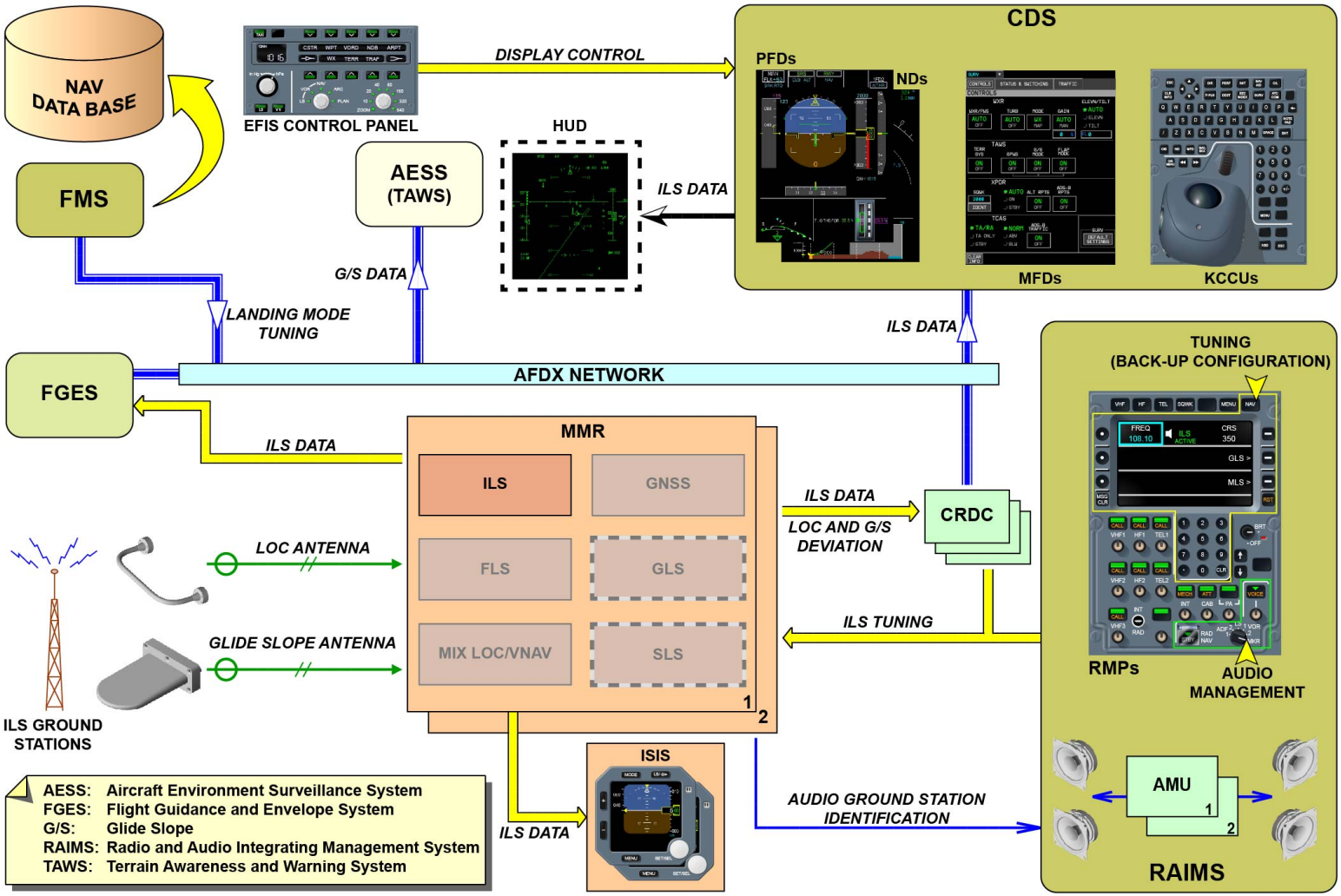
MULTI-MODE RECEIVER (MMR) DESCRIPTION (2/3)

LS Function: ILS

The ILS function gives the LOC and G/S deviation signals during approach and landing phases to the crew and A/C systems.
These deviation signals are calculated from the ILS data transmitted by the ILS ground stations (LOC and G/S ground stations) and received by the MMRs through the LOC and G/S antennas.
The ILS data (LOC and G/S deviation signals) calculated by the MMRs are sent to:
- The AFS for AP/FD function during final approach and landing phases
- The CDS for display of LOC and G/S deviation signals on the PFDs and NDs
- The HUD (if installed) for display of LOC and G/S deviation signals
- The AESS for the excessive G/S deviation mode in the Terrain Awareness and Warning System (TAWS) function.

The ILS data are sent to the PRIMs (AFS) and ISIS through the ARINC 429 bus and to the FMS, CDS, HUD, FWS, and AESS through the AFDX network and the CRDCs.
The EFIS control panels allow to control the display of ILS data on EFIS CDS (through each LS P/BSW).
The ILS landing mode selection is sent by the FMS to the MMR.
The ILS frequency tuning is normally automatic from the FMS and NAV database stored in the Flight Management Computers (FMCs).
It is also possible to manually set this tuning from the NAV database through the KCCU/MFD or the RMP in back-up NAV configuration (loss of the CRDC or FMS).
The ILS ground stations identification signal is sent to:
- The CDS through the AFDX network for display
- The Audio Management Units (AMUs) through analog signal for audio broadcasting of the related morse code
- The ISIS through the ARINC 429 bus for display.

V2414251 - V00T0MM0 - VM34D3MMR003001



ELECTRONIC

LS FUNCTION: ILS

MULTI-MODE RECEIVER (MMR) CONTROL AND INDICATING (2/3)

Global Navigation Satellite System (GNSS) (3)

Moreover, the GNSS position (latitude/longitude) is displayed on POSITION/MONITOR page of the MFD:

Instrument Landing System (ILS) (3)

In normal operation, each active Flight Management Computer (FMC), through the Common Remote Data Concentrator (CRDC) automatically tunes its own side radio navigation aids (VOR, DME, ADF, and MMR) through its related Radio and audio Management Panel (RMP). Note that the data (Identification, frequency, etc) related to these navigation aids are stored in the navigation database.
The radio navigation computers use the tuning data from port B and given by their own RMP from the same side. If no activity is detected by the RMP on this port, then the port A/B selection switches and tells the radio navigation receivers that they have to listen to the other port A, and bypass the RMP
In manual tuning mode, the crew uses the POSITION/NAVAIDS page through the Keyboard and Cursor Control Unit (KCCU) of the Multi Function Display (MFD). The manual settings are sent on the port B of the related radio navigation receivers through the CRDCs.
On this mode an underlined and dimmed M is shown near the NAVAID identification on the NDs.
If all CRDCs failed, the radio navigation receivers can be manually tuned through the RMPs. The CAPT and F/O can control their own side of the radio navigation receivers with the RMPs with a push on the STBY RAD NAV pushbutton switch.
On this mode an underlined and dimmed R is shown near the NAVAID identification on the NDs.
Note: Instrument Landing System (ILS) 1 and ILS 2, inside each MMR must be tuned on the same frequency. An ILS back-up tuning from RMP 1 or RMP 2 is sent to the two MMR 1 and MMR 2.

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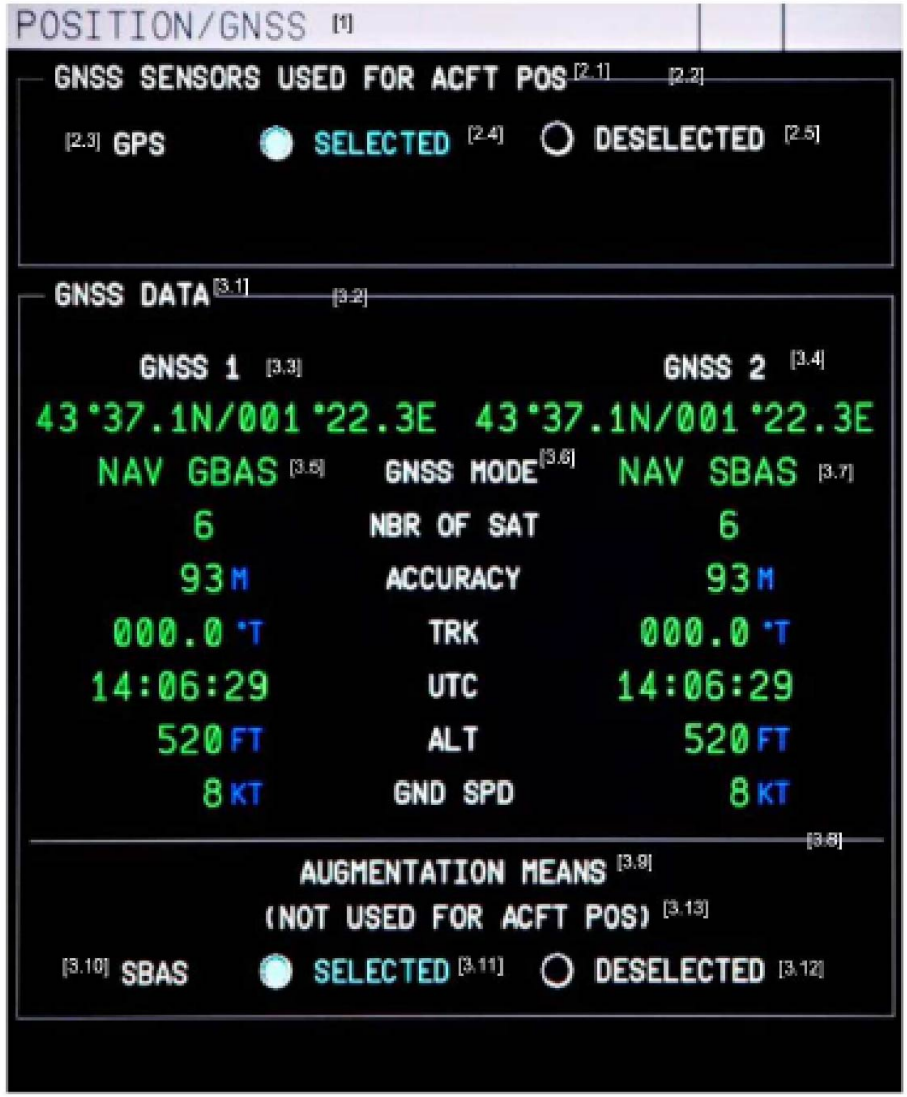
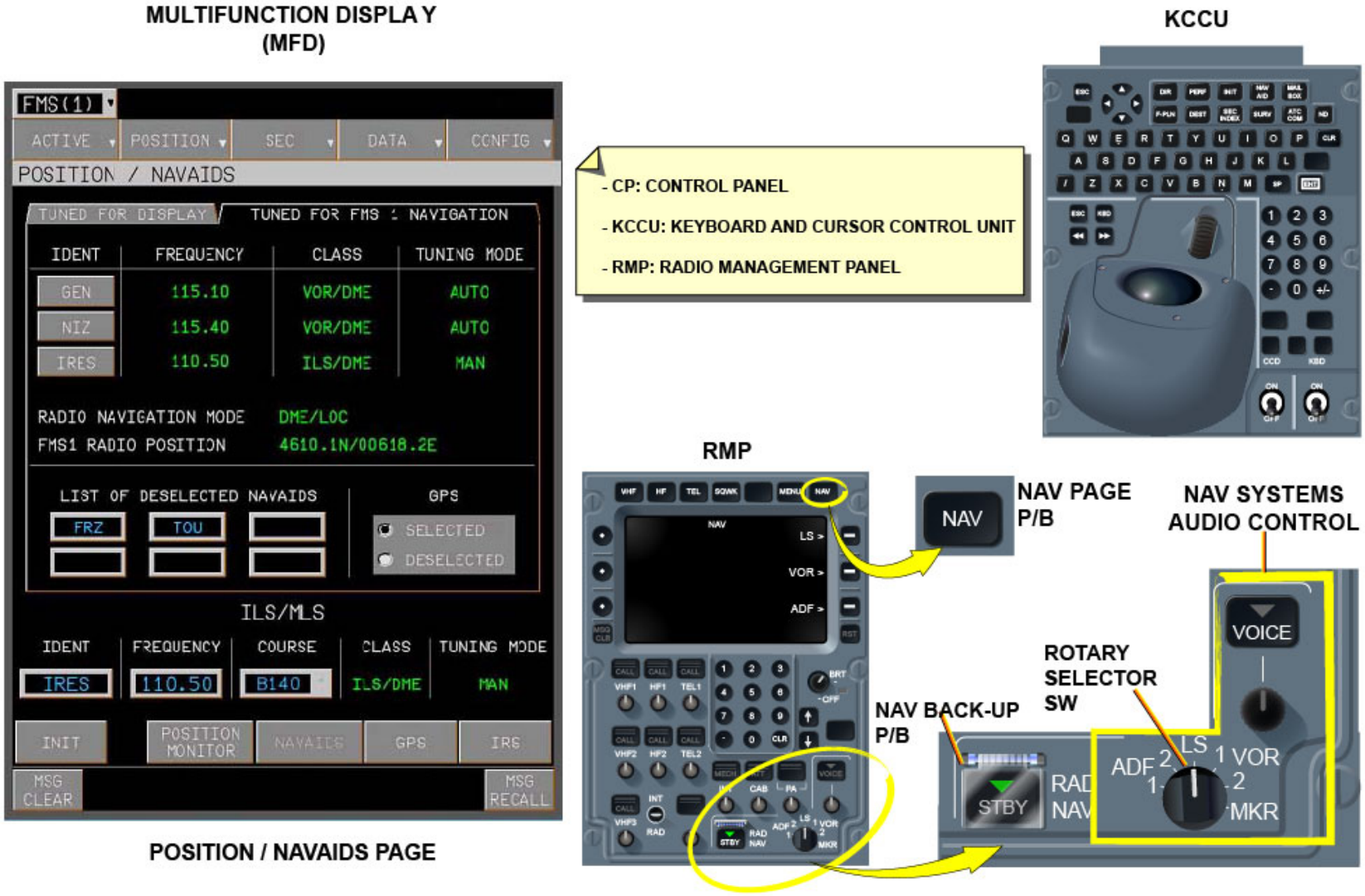
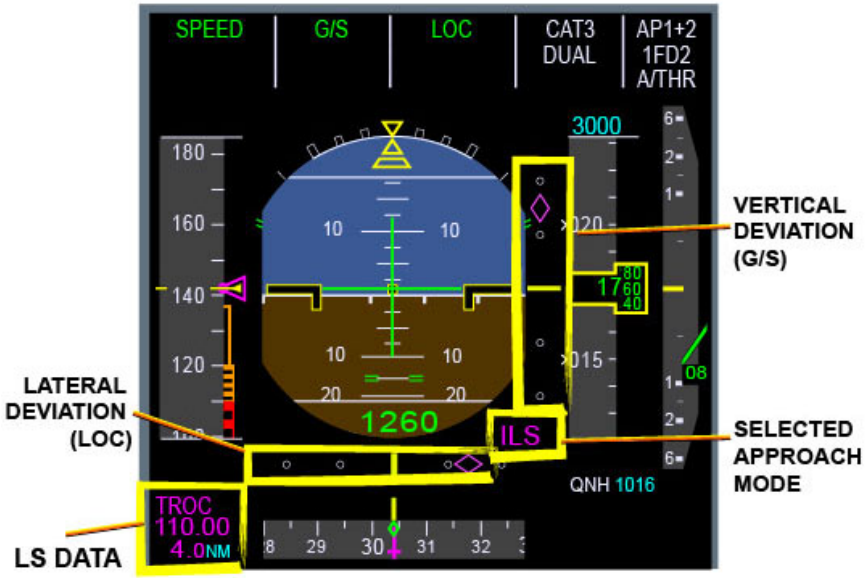


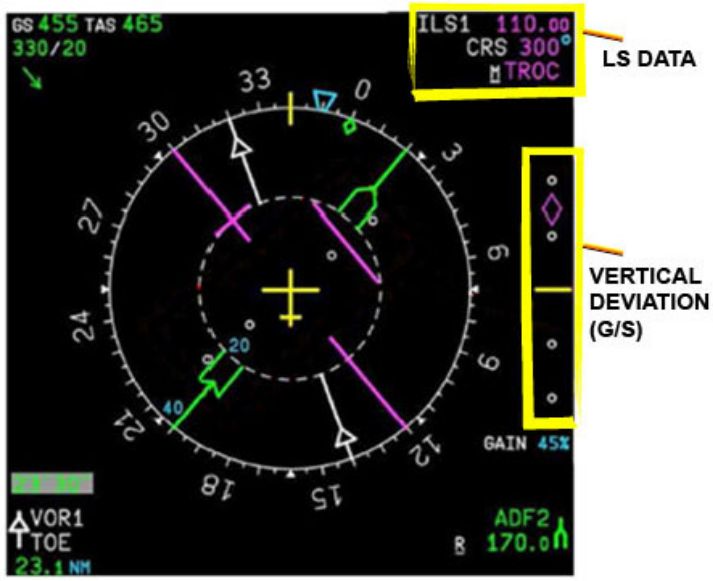
GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) (3) & INSTRUMENT LANDING SYSTEM (ILS) (3)



GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) (3) & INSTRUMENT LANDING SYSTEM (ILS) (3)



CAPT PFD



F/O ND IN ROSE MODE

PFD:	Primary Flight Display
ND:	Navigation Display
LS:	Landing System
CP:	Control Panel

F/O EFIS CP

GLOBAL NAVIGATION SATELLITE SYSTEM (GNSS) (3) & INSTRUMENT LANDING SYSTEM (ILS) (3)

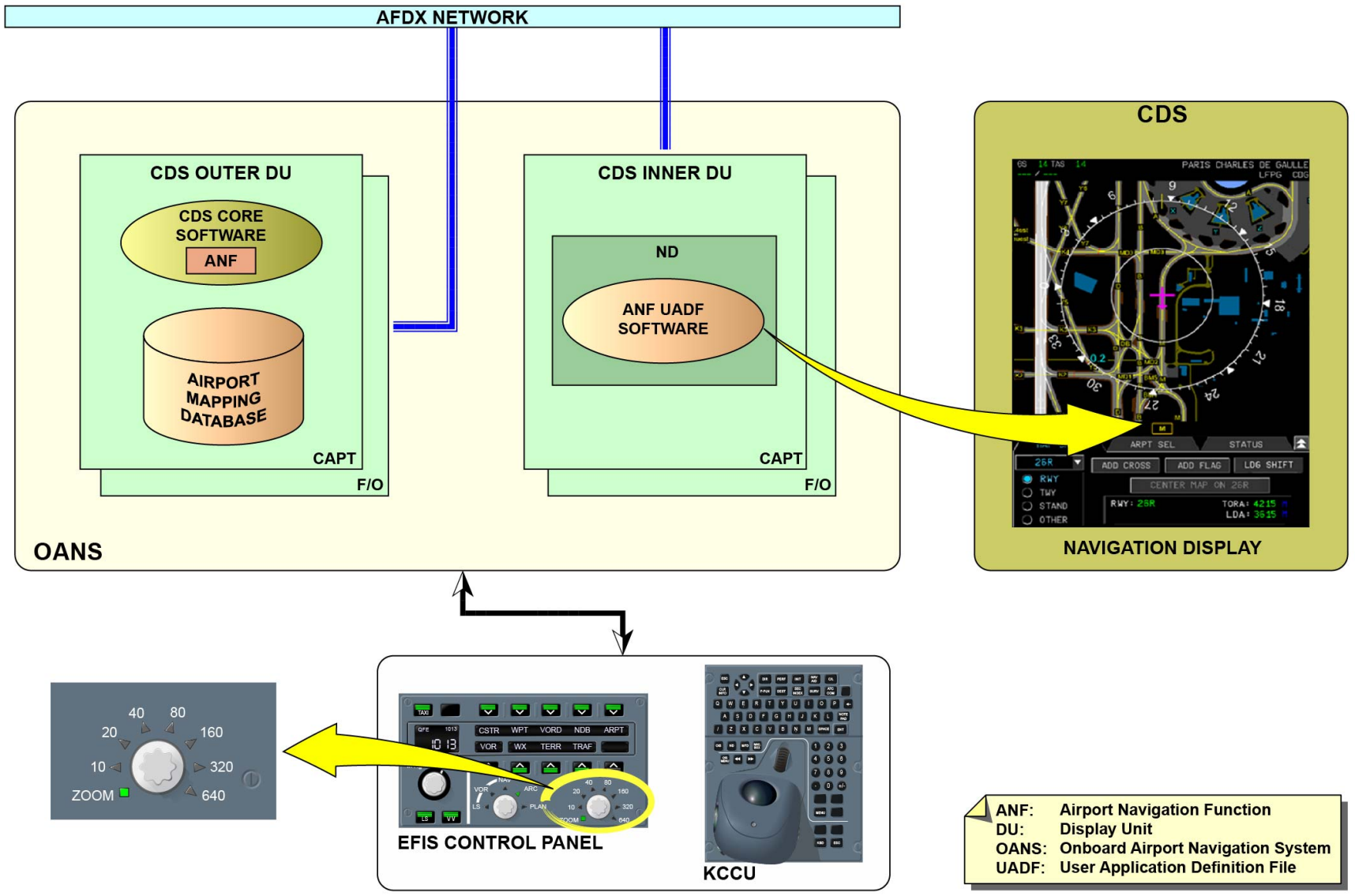
ONBOARD AIRPORT NAVIGATION SYSTEM DESCRIPTION (OPTION) (2/3)

General

The Airport Navigation Function (ANF) is an onboard function which helps the flight crew to improve their airport surface awareness. Then, it is possible for the pilot to prevent dangerous errors in surface navigation such as runway incursion or takeoff from the wrong runway. The function also helps decrease taxiing delays.
The Onboard Airport Navigation System (OANS) has:
- Three software components which are hosted in the six Display Units (DUs) of the CDS
- An Airport Mapping DataBase (AMDB)
- An ANF User Application Definition File (UADF) which is necessary for the DUs to display the ANF.
- An ANF application which is a part of the CDS core software, which only operates in the CAPT and F/O outer DUs, because of the CDS performances constraints (PFD and ND formats are highly demanding applications with regards to required processing performances).

The OANS generates two independent images on the related CAPT ND and/or F/O ND. The EFIS control panel activates them with the range selector in ZOOM position, the KCCU controls the images, in addition to the EFIS control panel back-up function.
Each time that a new airport selection is made (automatic or manual), the ANF application loads the appropriate airport map information from its related database. The ANF application generates all the necessary instructions (objects, size, position, etc.) which are then sent through the AFDX network to the onside CDS ND format.

V2414251 - V00T0MM0 - VM34D4OANS03001


AFDX NETWORK
CDS OUTER DU
CDS CORE SOFTWARE
ANF
AIRPORT MAPPING DATABASE
CAPT
F/O
CDS INNER DU
ND
ANF UADF SOFTWARE
CAPT
F/O
OANS
CDS
NAVIGATION DISPLAY
EFIS CONTROL PANEL
KCCU
ZOOM
ANF: Airport Navigation Function
DU: Display Unit
OANS: Onboard Airport Navigation System
UADF: User Application Definition File

GENERAL

ONBOARD AIRPORT NAVIGATION SYSTEM DESCRIPTION (OPTION) (2/3)

Description

The OANS has interfaces with:
- The LGERS:
- For the OMS applications: the CMS and DLCS. The UADF software and the AMDB software, hosted in the DUs of the CDS, are uploaded with the DLCS.
- For runway-proximity advisory inhibition in-flight.
- To find the map reference point (map centered on the A/C position on ground or airport reference point).
- To allow the BITE of the CDS, which monitors the OANS.
- The Air Data/Inertial Reference System (ADIRS), Flight Management System (FMS) for A/C data.
- The AMDB for airport data display
- The pilot data entries from the KCCUs.

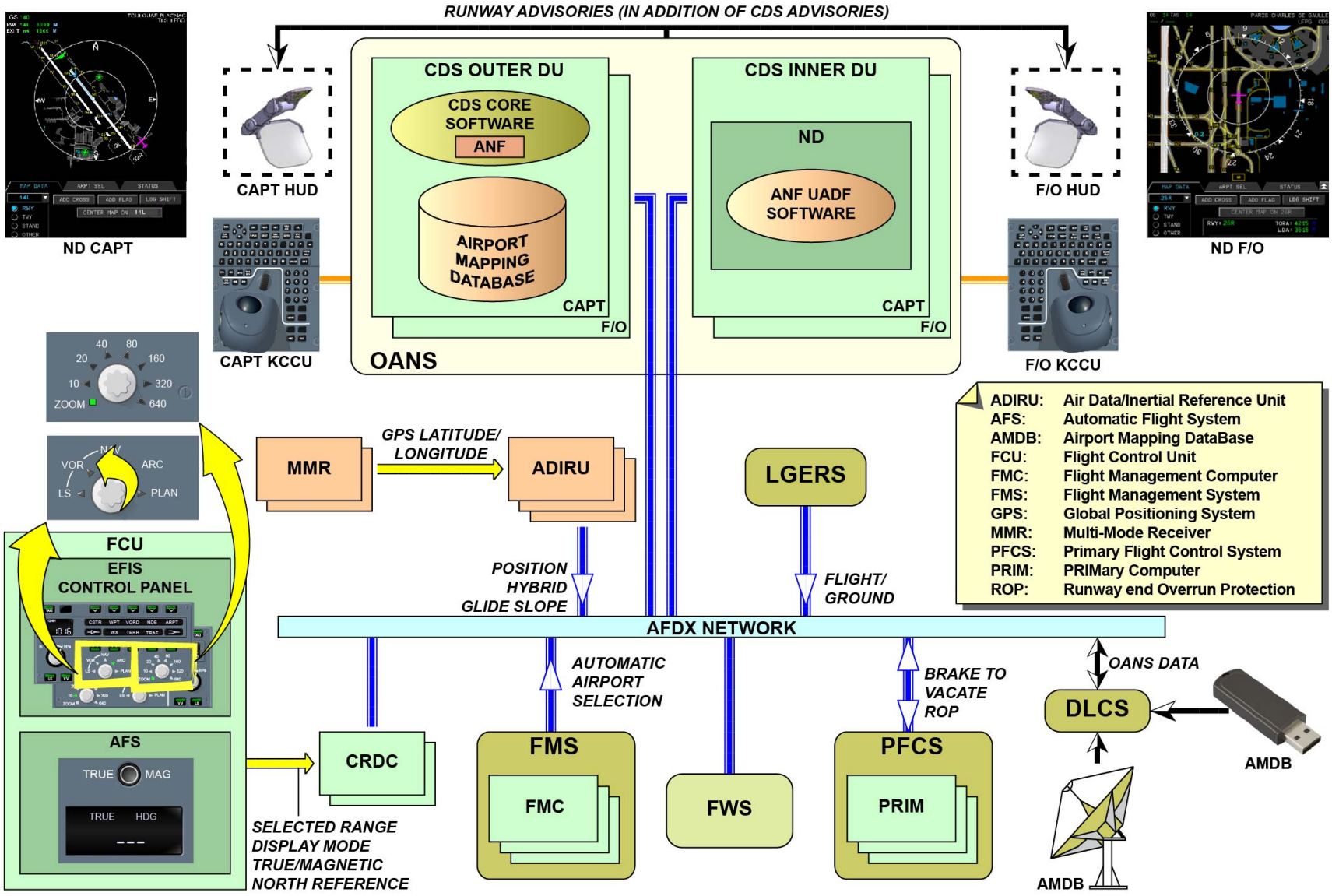
The ANF is also interfaced with the PRIMary Computers (PRIMs) for Brake To Vacate (BTV) (selection of landing runway, length and state of runway/wet-dry information) and Runway end Overrun Protection (ROP) function, etc. and hosts the approaching runway advisory function.
The FWS shows to the crew the messages related to the faults of the OANS and the warning messages generated by the ROP.
The OANS is also interfaced with the Head-Up Display (HUD) (when installed) to display runway advisories in addition to the PFD.

Control

The display of the airport moving map is done through:
- The EFIS control-panel mode selector: PLAN, NAV, ARC
- The EFIS control-panel range selector, ZOOM position
- The TRUE/MAG selection, for the north reference.

The CDS has an interface with the CAPT KCCU and the F/O KCCU through the Controller Area Network (CAN) bus.
When the OANS is activated on the ND, it is controlled by the onside KCCU.

V2414251 - V00T0MM0 - VM34D4OANS03001



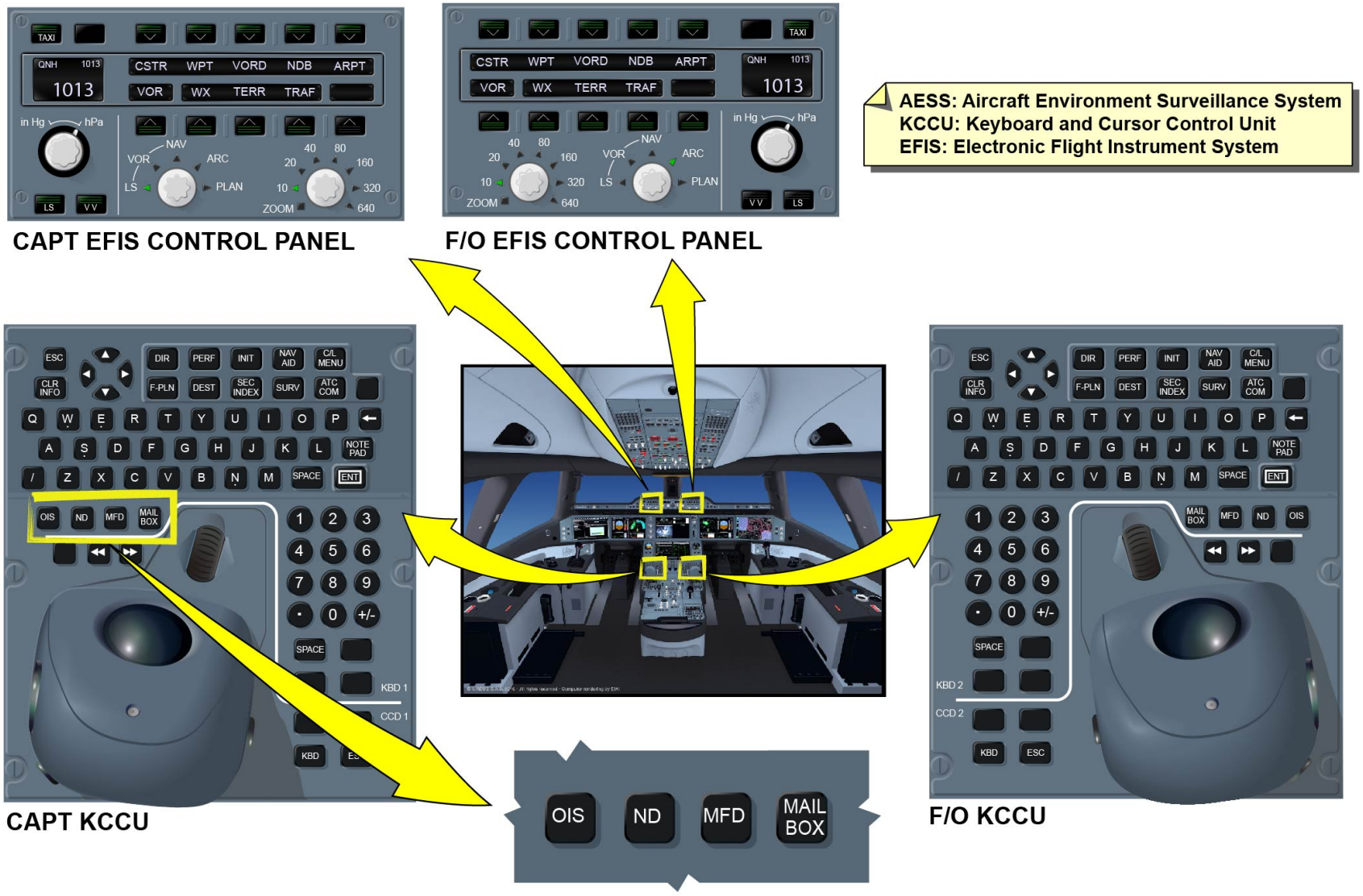
DESCRIPTION - CONTROL

ONBOARD AIRPORT NAVIGATION SYSTEM CONTROL AND INDICATING (OPTION) (2)

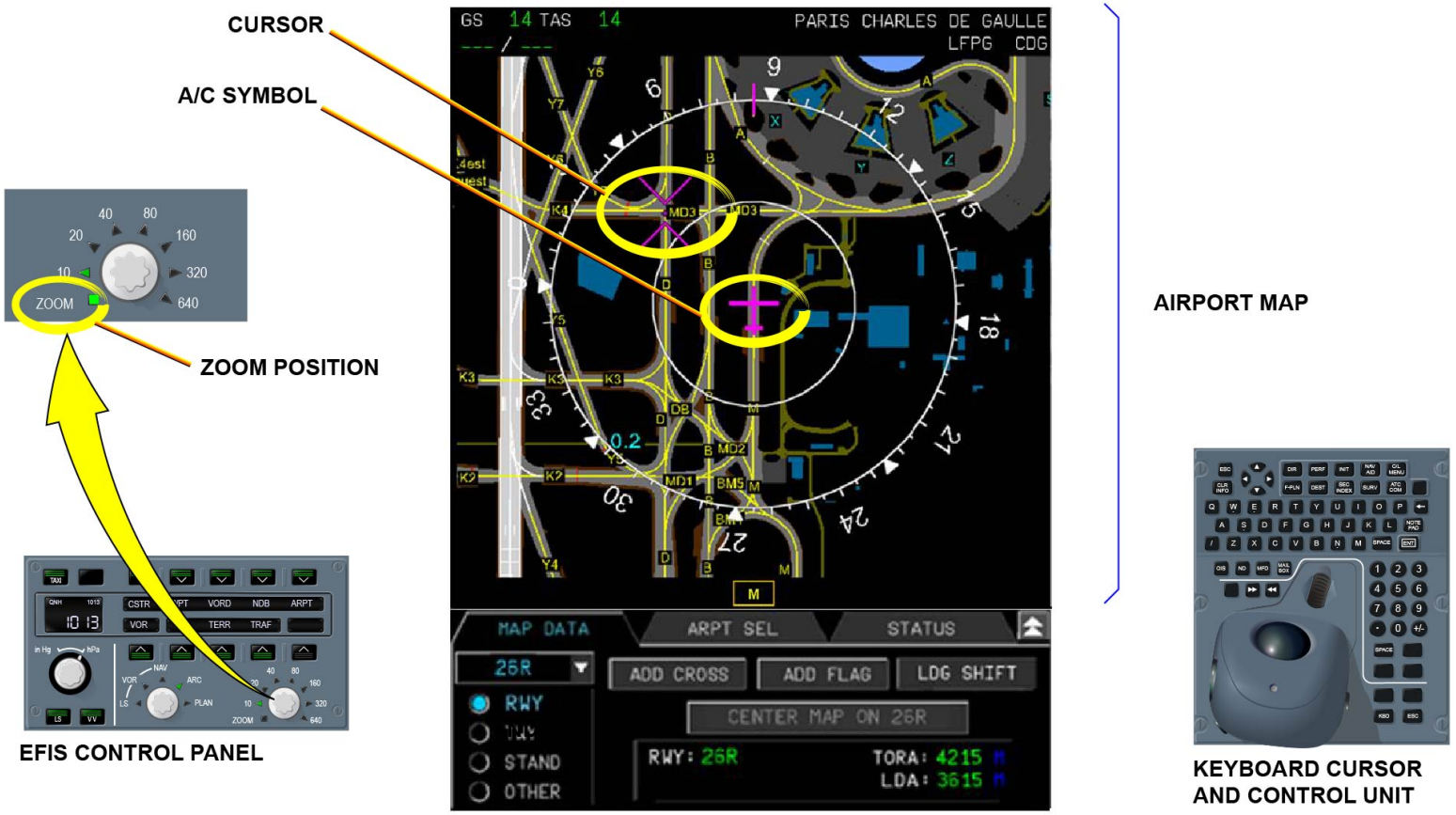
ANF Normal Operation (2)

The OANS gives the flight crew permanent data on the A/C location on the airport surface.
The fixed A/C symbol is shown on an electronic moving airport-map, in three different display modes: ARC, NAV, and PLAN.
The function supplies a set of data such as the name of the airport, taxiways, runways, gates and important building, current ground speed, and ground path.
The onside EFIS control panel range-selector (ZOOM position) shows the airport navigation image, on each ND.
The KCCU is used for direct interactivity with the airport navigation image.
The soft control panel agrees with the area on the ND interactive zone, at the bottom of the display and controlled through KCCU.
The aim of the soft control panel is to let the crew interact with the airport map through an applicable interface.
The soft control panel has three pages:
- MAP DATA page: data related to a given runway or taxiway,
- ARPT SEL page: manually selects an airport and shows the related map,
- STATUS page: gives the part number and the validity period related to the active AMDB.

V2414251 - V00T0MM0 - VM3414OANS02301

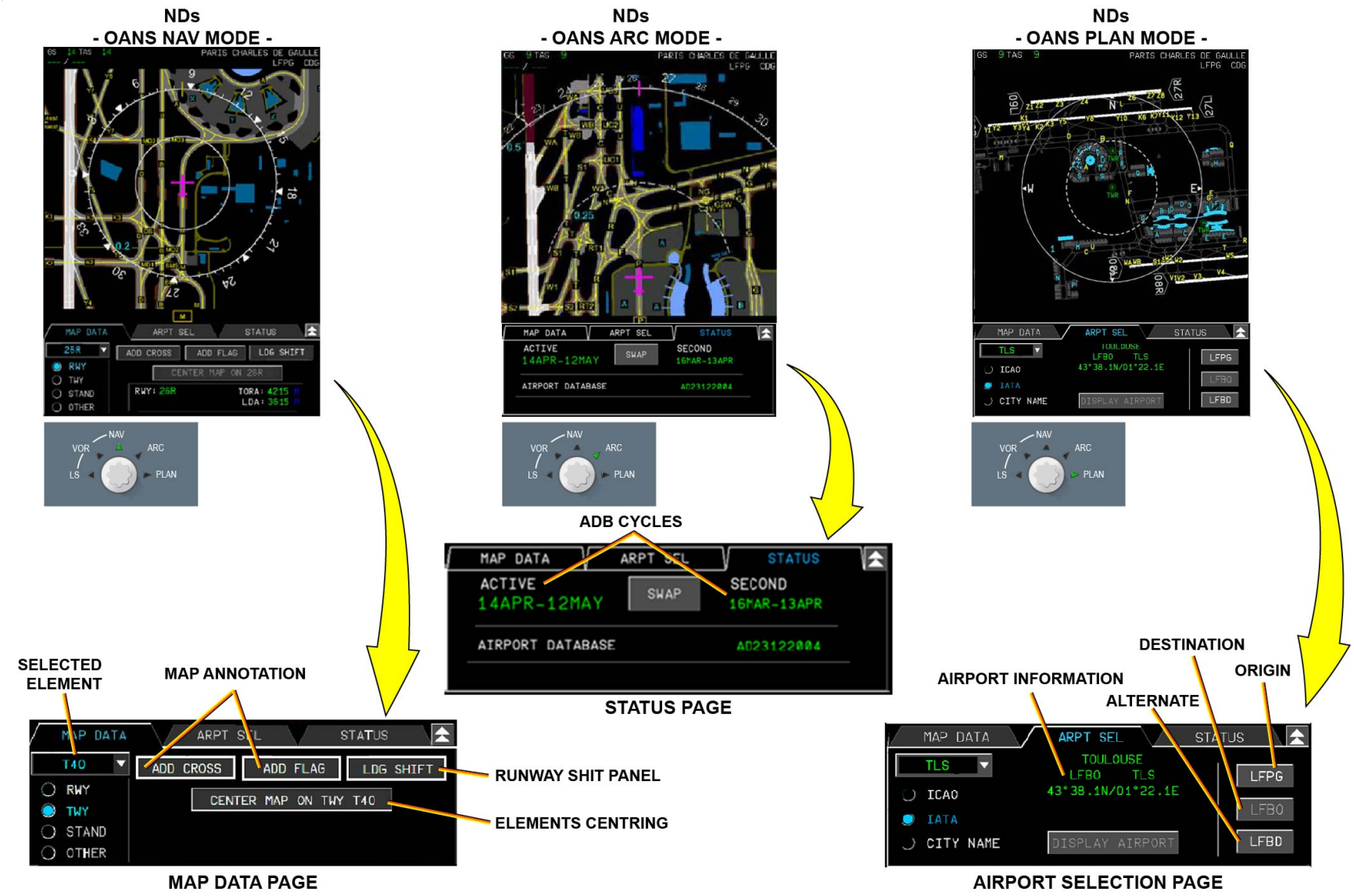


ANF NORMAL OPERATION (2)



ANF NORMAL OPERATION (2)

V2414251 - V00T0MM0 - VM3414OANS02301



ANF NORMAL OPERATION (2)

V2414251 - V00T0MM0 - VM3414OANS02301

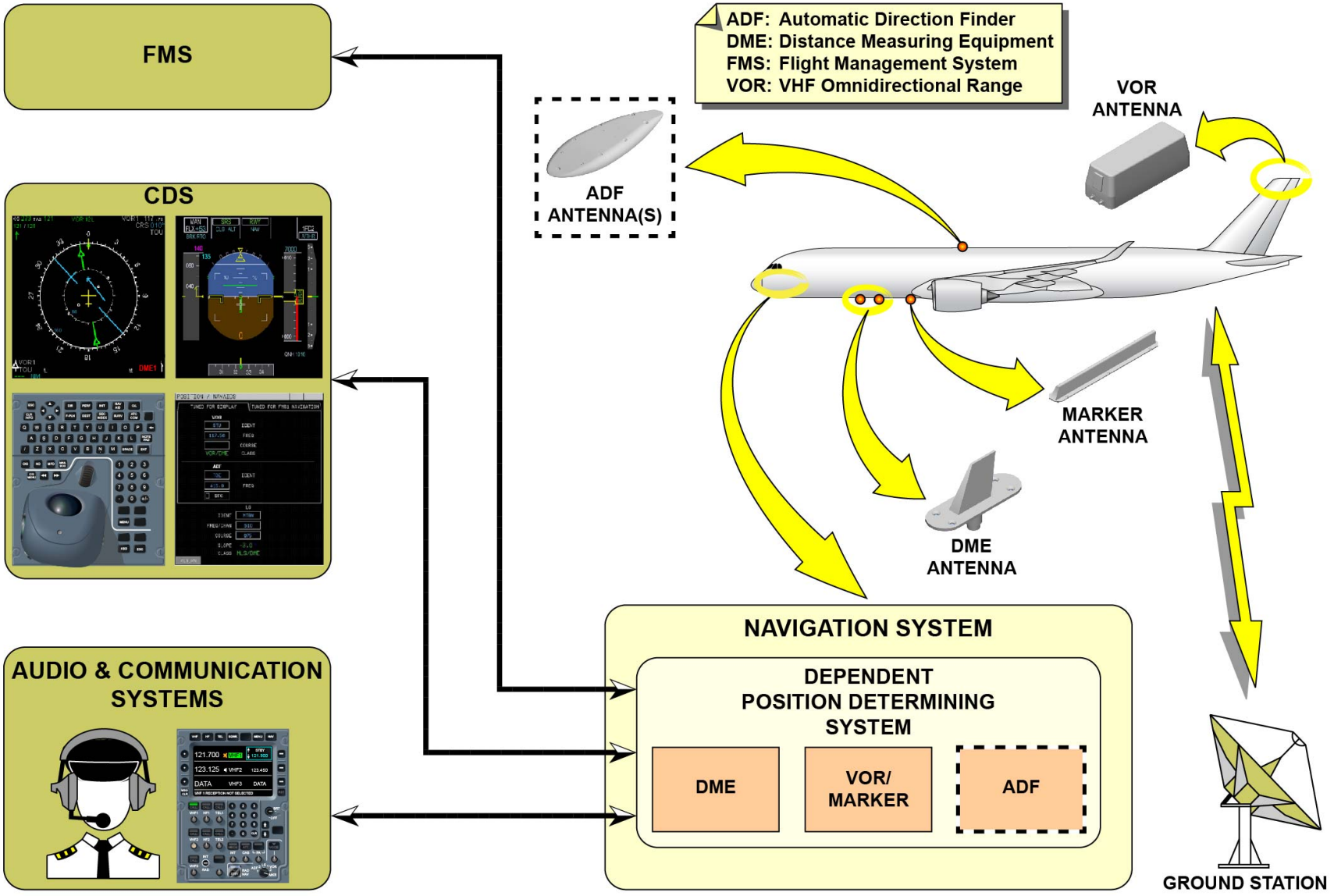
DEPENDENT POSITION DETERMINING SYSTEM DESCRIPTION (2/3)

General

This system is dependent of the ground stations. It gives:
- The navigation data to the CDS and Flight Management System (FMS)
- The identification of the ground stations to the Radio and Audio Integrating Management System (RAIMS).

The system includes:
- A VHF Omnidirectional Range (VOR)/Marker (radio) Beacon (MKR) system, with a VOR antenna installed on the top of the vertical stabilizer and a marker antenna at the bottom of the A/C.
- A Distance Measuring Equipment (DME) system, with antennas installed at the bottom of the center fuselage.
- One or two optional Automatic Direction Finder (ADF) system, with ADF antennas mounted on the top of fuselage.

V2414251 - V00T0MM0 - VM34D5RNAV03001


FMS
CDS
AUDIO & COMMUNICATION SYSTEMS
ADF: Automatic Direction Finder
DME: Distance Measuring Equipment
FMS: Flight Management System
VOR: VHF Omnidirectional Range
ADF ANTENNA(S)
VOR ANTENNA
MARKER ANTENNA
DME ANTENNA
NAVIGATION SYSTEM
DEPENDENT POSITION DETERMINING SYSTEM
DME
VOR/ MARKER
ADF
GROUND STATION

GENERAL

DEPENDENT POSITION DETERMINING SYSTEM DESCRIPTION (2/3)

VOR/MKR Description

The VOR/MKR system is a radio navigation aid which has two functions (the navigation signal allows the airborne receiving equipment to determine a magnetic bearing at the time of the installation):
- The VOR function, which determines:
- The magnetic bearing from the station to the A/C (direction from the VOR station in relation to the magnetic North of the Earth)
- The indication of the selected course
- The aural and digital identification of the selected ground station.
- The MKR function, which indicates during the landing approach phase, when the A/C is flying over the marker transmitters installed on the ground at known distances, with respect to the runway axis threshold.

The VOR system includes:
- A VOR/MKR unit 1
- An optional VOR2 unit
- One dual VOR antenna
- One MKR antenna, which is connected only to the VOR/MKR1 receiver for MKR function.

The MKR function is active on the VOR/MKR1, but the two VOR receiver units are interchangeable.
The normal tuning of the VOR/MKR system is done from the FMS/MFDs through the Radio and Audio Management Panels (RMPs) (port B).
Selecting off the RMP when there is a failure, the VOR unit switches to port A to directly receive the tuning commands from the FMS/MFDs.

Interfaces

The VOR/MKR receiver is connected to the CRDCs to send VOR/MKR data through the AFDX network for the following systems:
- The FMS, for radio-navigation parameters and status information.

In normal operation, tuning data are transmitted from the Flight Management Computers (FMCs) to the VOR/MKR receiver through the RMPs. The FMS gives the tuning selection information and the VOR selected course to the VOR/MKR.
- The CDS, for data display.

The tuning of the station and the selection of the course can be made by different means:
- Automatic tuning (normal tuning)

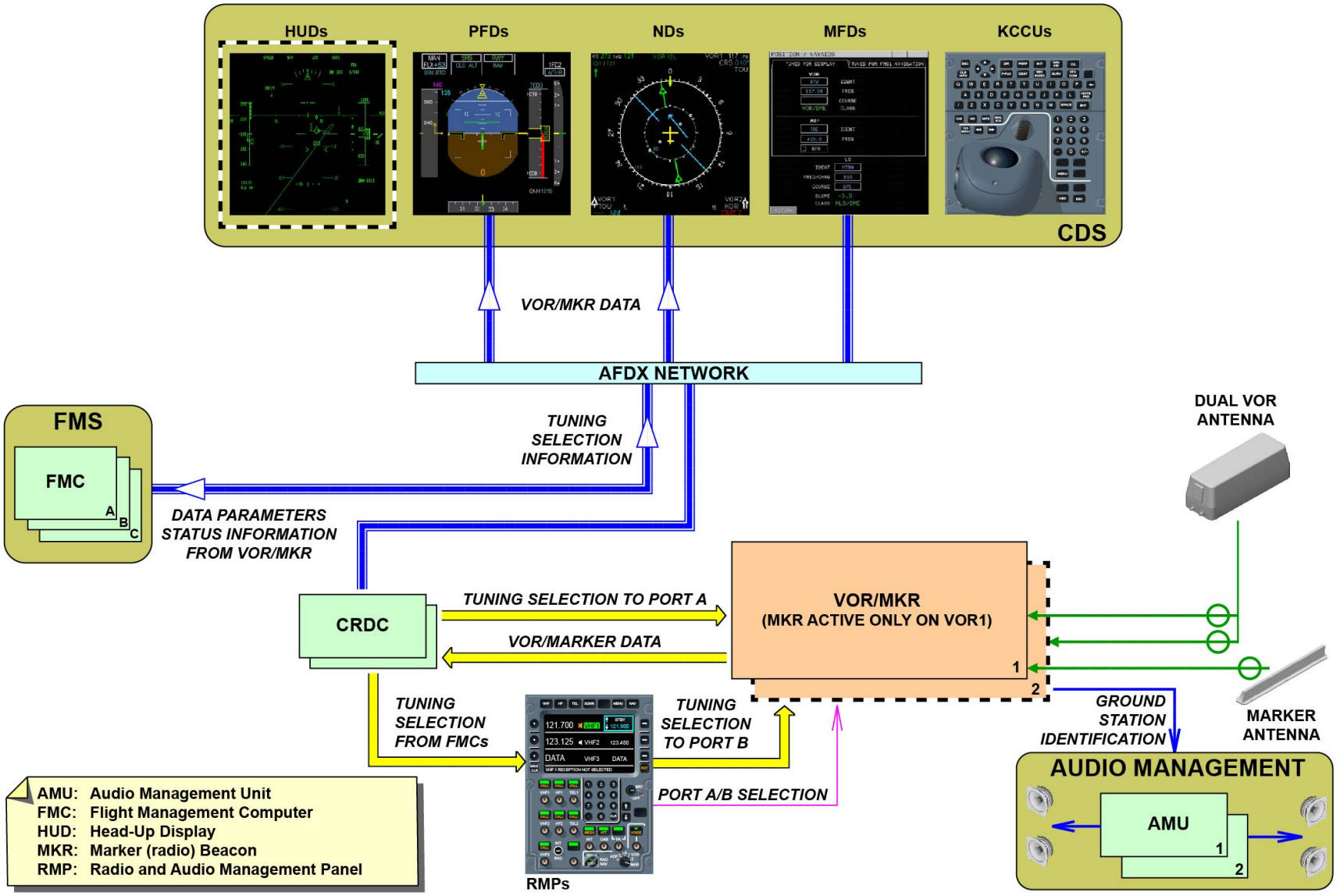
In normal tuning operation, the FMS provides the VOR/MKR with tuning selection information, which has been selected automatically.
- Manual tuning

It is possible to tune a frequency manually and to select a course by fulfilling frequency/course or identification fields on the dedicated Radio (RAD) NAV and VOR page through the MFD (tuning and selection done through the FMS).
- Manual back-up tuning

If there is a loss of normal tuning (a failure of the FMC or CRDC function), it is also possible to use the RMP.
The VOR/MKR can receive tuning data from two input ports:
- The port B (automatic and manual tuning), which receives data from the FMCs through the AFDX network, then the CRDC and finally the RMP. The RMP is transparent in this normal operation mode.
- The port A (manual back-up tuning), which receives data directly from the FMCs through the AFDX network and then the CRDC.

The VOR receiver is connected to the two Audio Management Units (AMUs) to give to the crew the aural identification of the selected and displayed ground stations.
In option, a second VOR unit can be installed, interchangeable with the standard VOR/MKR unit, but the MKR function is not activated.

V2414251 - V00T0MM0 - VM34D5RNAV03001



VOR/MKR DESCRIPTION - INTERFACES

DEPENDENT POSITION DETERMINING SYSTEM DESCRIPTION (2/3)

DME Description

The DME is a radio navigation aid that gives:
- The distance between the A/C and the selected ground station
- The audio signal for the identification of the DME ground station.

The A/C can have two DME systems. The second DME system is optional.
Each system has:
- A DME transceiver
- A DME antenna.

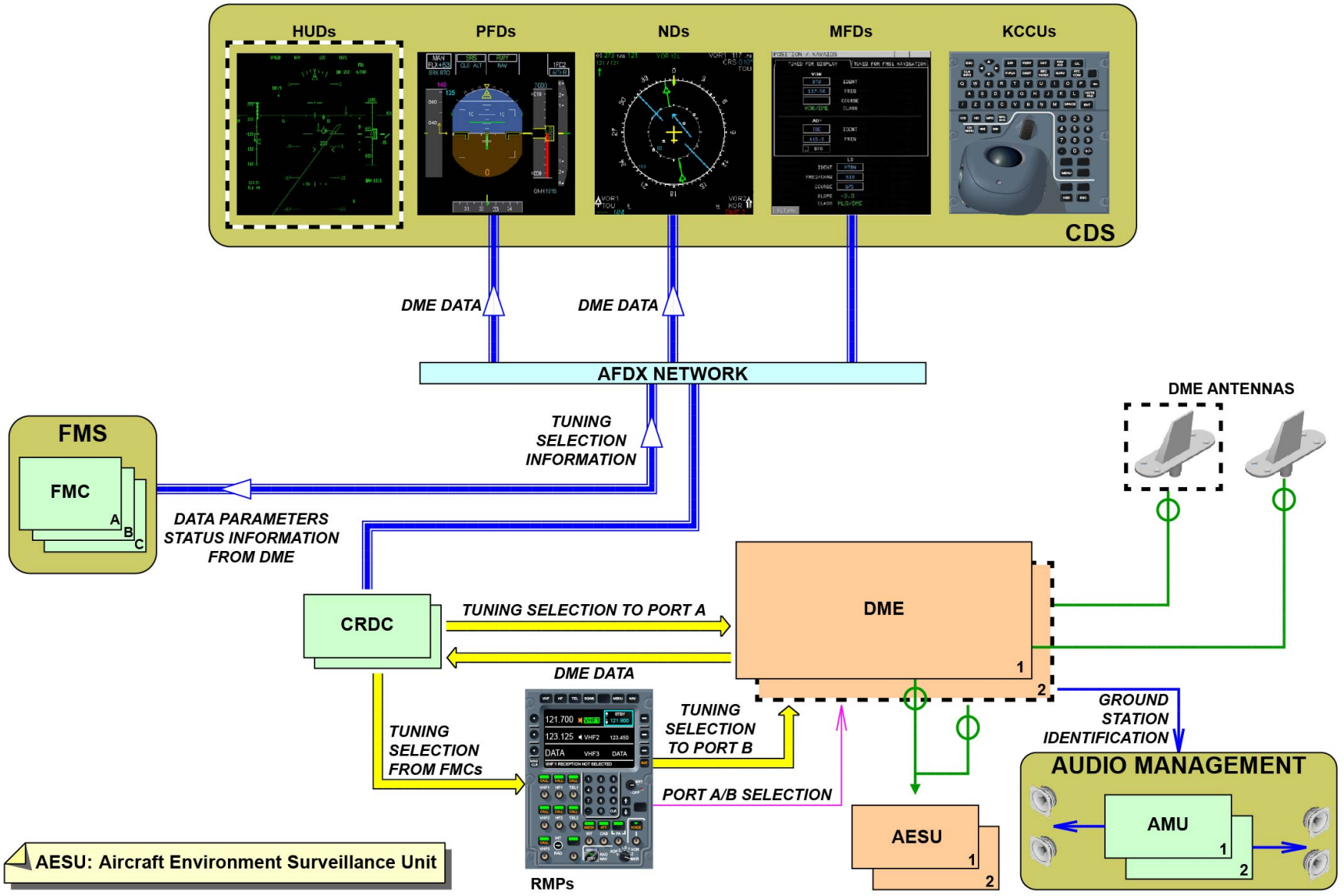
The normal tuning of the DME system is done from the FMS through the RMPs (port B). Selecting off the RMP when there is a failure, the DME unit switches to port A to directly receive the tuning commands from the FMS.

Interfaces

Each DME transceiver is connected to the two AMUs to give to the crew the audio-identification signal of the selected ground stations.
The DME is connected to the CRDCs to send the DME data through the AFDX network to the following systems:
- The FMS, for radio-navigation parameters and status information
- The CDS, for data display.

Each DME transceiver is connected to the Aircraft Environment Surveillance System (AESS). The pulse suppressor signal is used to prevent interferences transmission between DMEs and Air Traffic Controls (ATCs).
The tuning of the station can be made by the automatic tuning (normal tuning). In normal tuning operation, the FMS gives tuning selection information to the DME, which has been selected automatically.
Each DME can receive tuning data from two input ports:
- The port B, which receives data from the FMCs through the AFDX network, then the CRDC and finally the RMP
- The port A, which receives data directly from the FMCs through the AFDX network and then the CRDC.

V2414251 - V00T0MM0 - VM34D5RNAV03001



DME DESCRIPTION - INTERFACES

DEPENDENT POSITION DETERMINING SYSTEM DESCRIPTION (2/3)

ADF Description

The optional ADF system is dependent of the ground stations. The ADF receiver determines the relative bearing to the selected ground station. Dedicated aviation ground-navigation-stations send a morse coded signal to be identified.
The ADF system gives:
- The navigation data to the CDS and FMS
- The identification signal (morse code) of the selected ground station to the audio and communication system.

The system includes:
- An ADF receiver
- An ADF antenna.

Interfaces

Each ADF receiver is connected to the two AMUs and gives to the crew the audio identification of the selected ground station.
The ADF is connected to the CRDCs to send the ADF data through the AFDX to be used by:
- The CDS/NDs.

The tuning of the station can be made by different means:
- Automatic tuning (normal tuning)

In normal tuning operation, the FMS provides the ADF with tuning selection information, which has been automatically or manually selected.
Each ADF can receive tuning data from two input ports:
- The port B, which receives data from the FMCs through the AFDX network, then the CRDC and finally the RMP. The RMP is transparent in this normal operation mode.
- The port A, which receives data directly from the FMS through the AFDX network and then the CRDC.

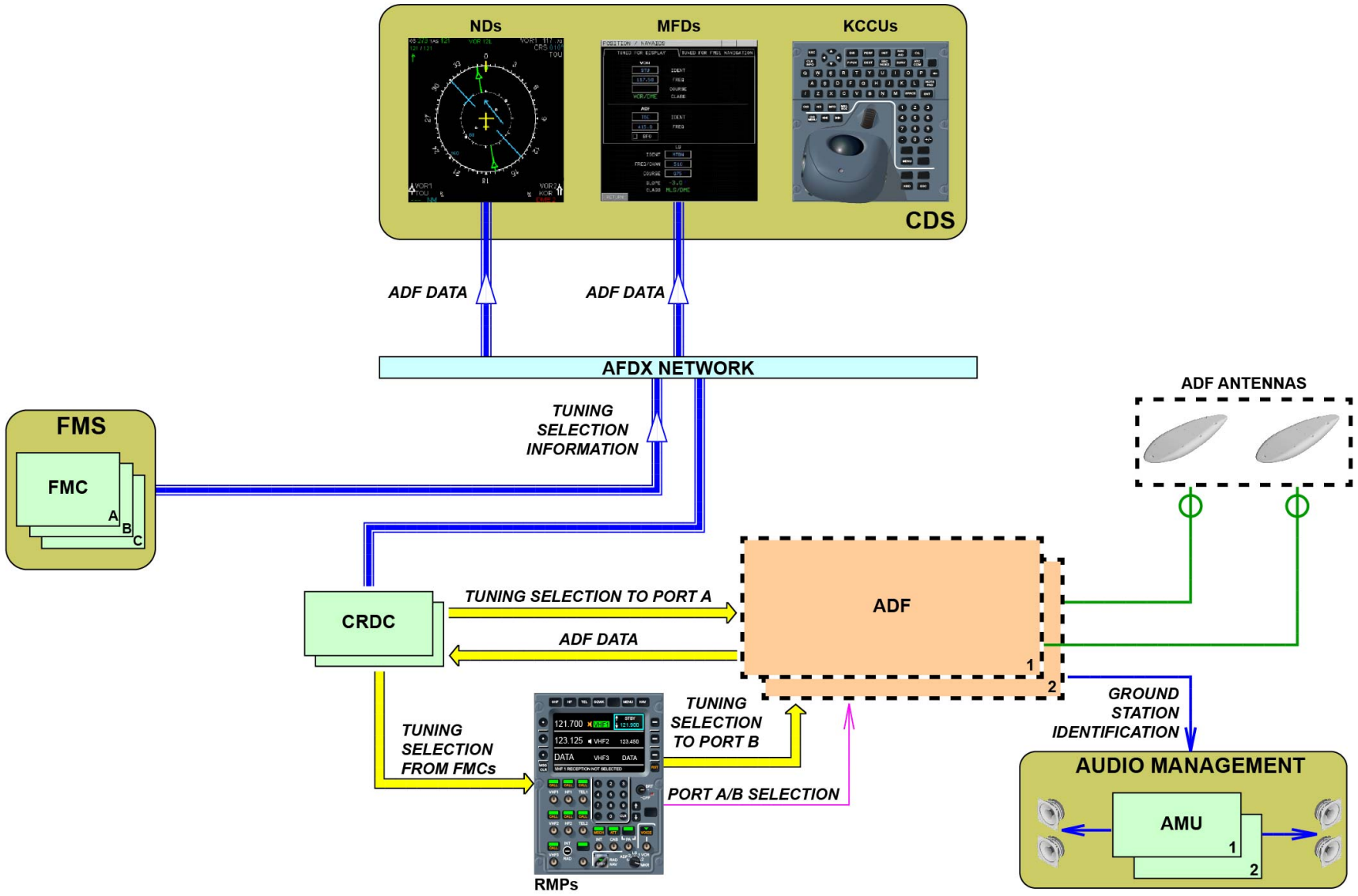
The ADF input port selection is done by the RMP through the discrete port A/B selection signal:
- In normal operation, the RMP orders the ADF to receive the tuning data on the port B.
- The RMP, which monitors its input bus, orders the ADF to receive tuning data on the port A if there is a FMS failure or a CRDC failure.

- Manual tuning

It is possible to tune a frequency manually by selecting the frequency or identification fields on the dedicated RAD NAV and ADF page through the MFD (tuning and selection done through the FMS).
- Manual back-up tuning

If there is a loss of the normal tuning (a failure of the FMS or CRDC function), it is also possible to use the RMP (Nav-Back mode engaged) and thereafter go to the ADF page.

V2414251 - V00T0MM0 - VM34D5RNAV03001



ADF DESCRIPTION - INTERFACES

DEPENDENT POSITION DETERMINING SYSTEM CONTROL AND INDICATING (2/3)

ADF Operation (2/3)

Tuning can be made by 3 different means.
Automatic tuning: In normal operation, tuning data are transmitted from each FMS to its own-side ADF via own-side RMP.
Manual Tuning: It is manually possible to tune a frequency by selecting frequency or identification fields on dedicated RAD NAV and ADF page through MFD (tuning and selected performed via FMS).
Manual Back-up Tuning: In case of loss of normal tuning it is also possible to use the RMP by pushing STBY button (Nav-Back mode engaged) and thereafter going to ADF page.

VOR/DME Operation (2/3)

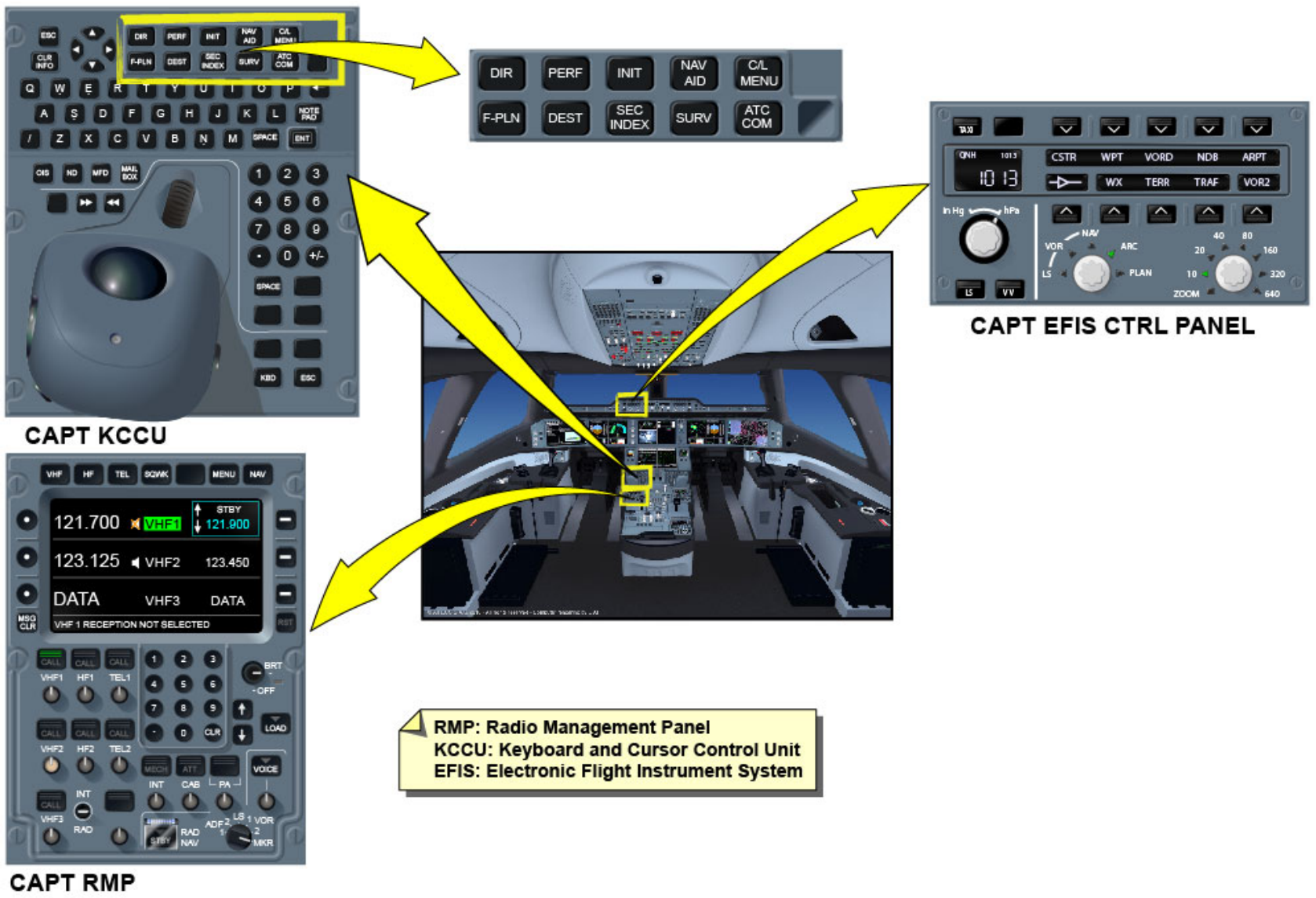
Tuning can be made by 3 different means.
Automatic Tuning
In normal operation, the FMS provides the Radio Navigation set with tuning selection information (VOR/DME/ADF) and selected course (VOR/ADF), which has been automatically selected (from flight plan) .
Manual Tuning
In manual tuning mode (in case of failure of auto-tuning for example), the crew uses the POSITION/NAVAIDS page KCCU/MFD.
On this mode a "M" underlined and dimmed is displayed near the Navaid identification on NDs.
Backup Tuning
The CAPT and F/O use their RMPs to tune manually their own side radio navigation receivers by pushing STAND BY RAD/NAV button and going to NAV page.
Tuning RMP control:
On RMP, the guarded RAD NAV STBY key allows activation of the standby radio navigation mode. It allows the radio selected navigation means (ADF1, ADF2, VOR1, VOR2, LS, MKR) to be listened and controlled by the general Radio NAV potentiometer. (The green STBY legend comes on and you can adjust the radio navigation parameters through the RMP).
The NAV menu main page is automatically shown on the RMP.
On RH side of the screen, push the Line Selection Key (LSK) of the VOR line to get the VOR page. The system shows the VOR page.
The VOICE MODE key allows the inhibition of radio navigation equipment identification signals.
When pressed: VOICE legend illuminates green and identification signals are filtered out, only voice is heard.
The general potentiometer for volume adjustment of the radio navigation means controls the audio level of the Radio NAV (MKR, LS, ADF, VOR) selected.
The navigation pages selection key (NAV) allows access to NAV pave page only if the radio navigation standby mode is activated (RAD NAV/STBY key pushed).
Tuning VOR sub-page:
On this sub-page, it is possible to:
- Select a course (CRS) or frequency (FREQ) for modification
- Modify the VOR course or frequency in the CRS or FREQ field.

Tuning indicating:
On the PFD, the VOR information is shown in magenta in the bottom left corner of the PFD, as follows:
-
VOR station identification
-
VOR frequency
These data come into view when you push the LS pushbutton switch located on the EFIS control panel of the Flight Control Unit (FCU), if the related VOR signals are valid.
When the ground station is out of range, the VOR information is not computed data and the station characteristics go out of view. Dashes are shown in green in place of the station characteristics.

V2414251 - V00T0MM0 - VM34I5RNAV03001

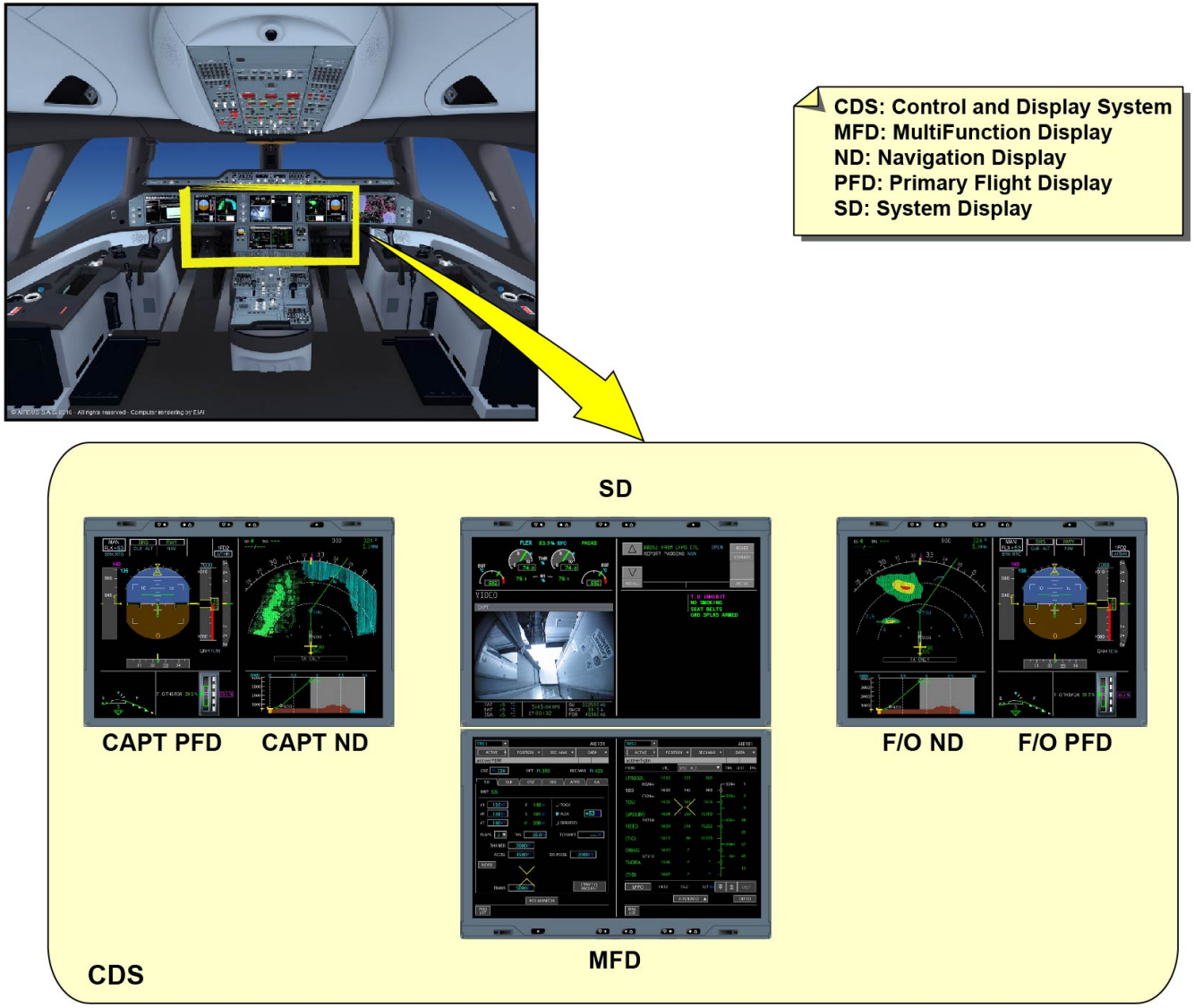
In case of equipment failure, a red VOR message is displayed in place of the station characteristics.
The tuning mode is shown as follows:
-
No data if automatically tuned
-
M underlined if manually tuned from the MFD
-
R underlined if manually tuned from the RMP (in back-up mode).
When the ground station is out of range, the VOR information is not computed data and the station characteristics go out of view. Dashes are shown in green in place of the station characteristics.
In case of equipment failure, a red VOR message is displayed in place of the station characteristics. This message flashes during 9 seconds, then it remains steady.
NOTE:
When the distance is less than 20 NM, the tens of NM are displayed.
In ROSE mode:
Two needles show the relative bearing of VOR1 and VOR2. A single pointer on the heading dial shows VOR1 heading. A double pointer shows VOR2 heading. All these indications are shown in white.
A dagger-shaped pointer points to the selected VOR course (cyan).
A lateral deviation bar that shows the VOR deviation has an arrow for the TO/FROM indication (cyan).
These VOR indications come into view in the right top corner: VOR1 (CAPT ND) or VOR2 (F/O ND), frequency, selected course, identification.
In ARC mode:
The VOR-D pushbutton switch on the EFIS control panel of the FCU is used to show information not included in the flight plan. This information is about the VOR stations and their locations. It is shown as a cross symbol for a VOR station and a circle and cross symbol for a VOR/DME station.
When the ground station is out of range, the VOR information is not computed data and the station characteristics go out of view. Dashes are shown in green in place of the station characteristics.
In case of equipment failure, a red VOR message is displayed in place of the station characteristics. This message flashes during 9 seconds, then it remains steady.
NOTE:
When the distance is less than 20 NM, the tens of NM are displayed.

V2414251 - V00T0MM0 - VM34I5RNAV03001



ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)

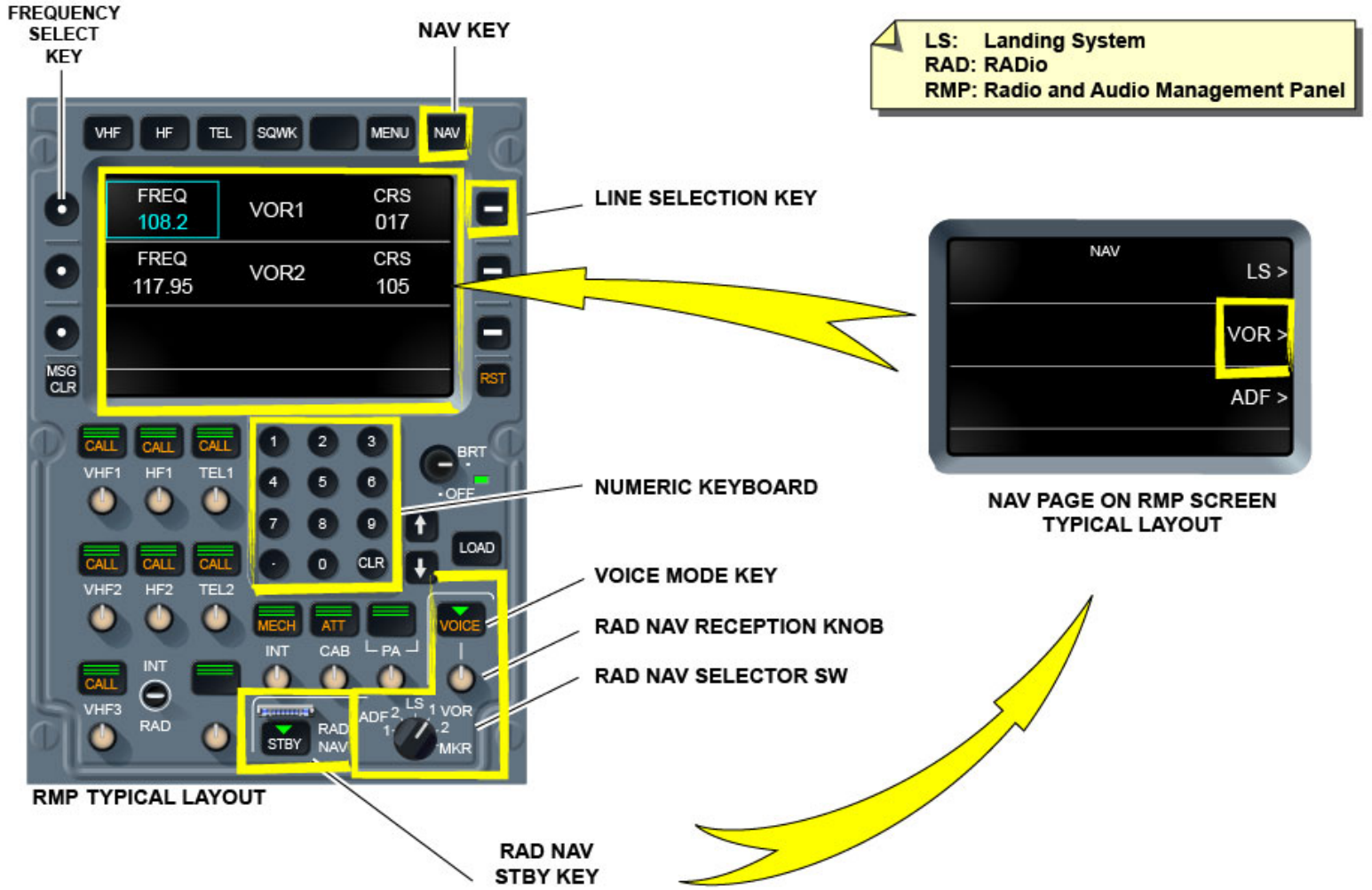
V2414251 - V00T0MM0 - VM3415RNAV03001



ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)

POSITION/NAVAID PAGE ON MFD TYPICAL LAYOUT

ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)



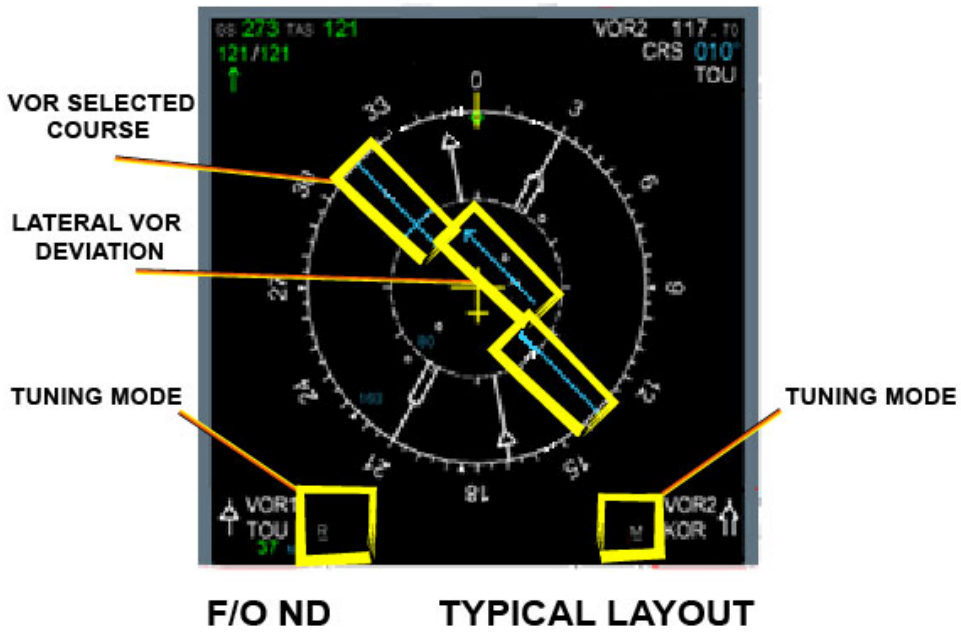
ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)

RMP TYPICAL LAYOUT

RMP TYPICAL LAYOUT

RMP: Radio Management Panel

ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)



ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)

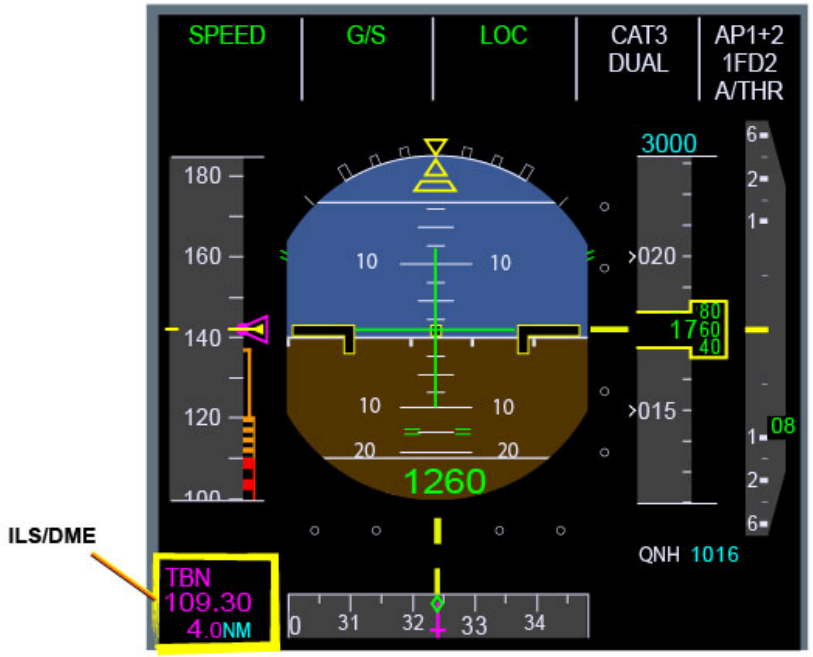
V2414251 - V00T0MM0 - VM34I5RNAV03001

F/O EFIS CONTROL PANEL

F/O ND TYPICAL LAYOUT

V2414251 - V00T0MM0 - VM34I5RNAV03001

ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)



PFD TYPICAL LAYOUT

ADF OPERATION (2/3) & VOR/DME OPERATION (2/3)

V2414251 - V00T0MM0 - VM34I5RNAV03001

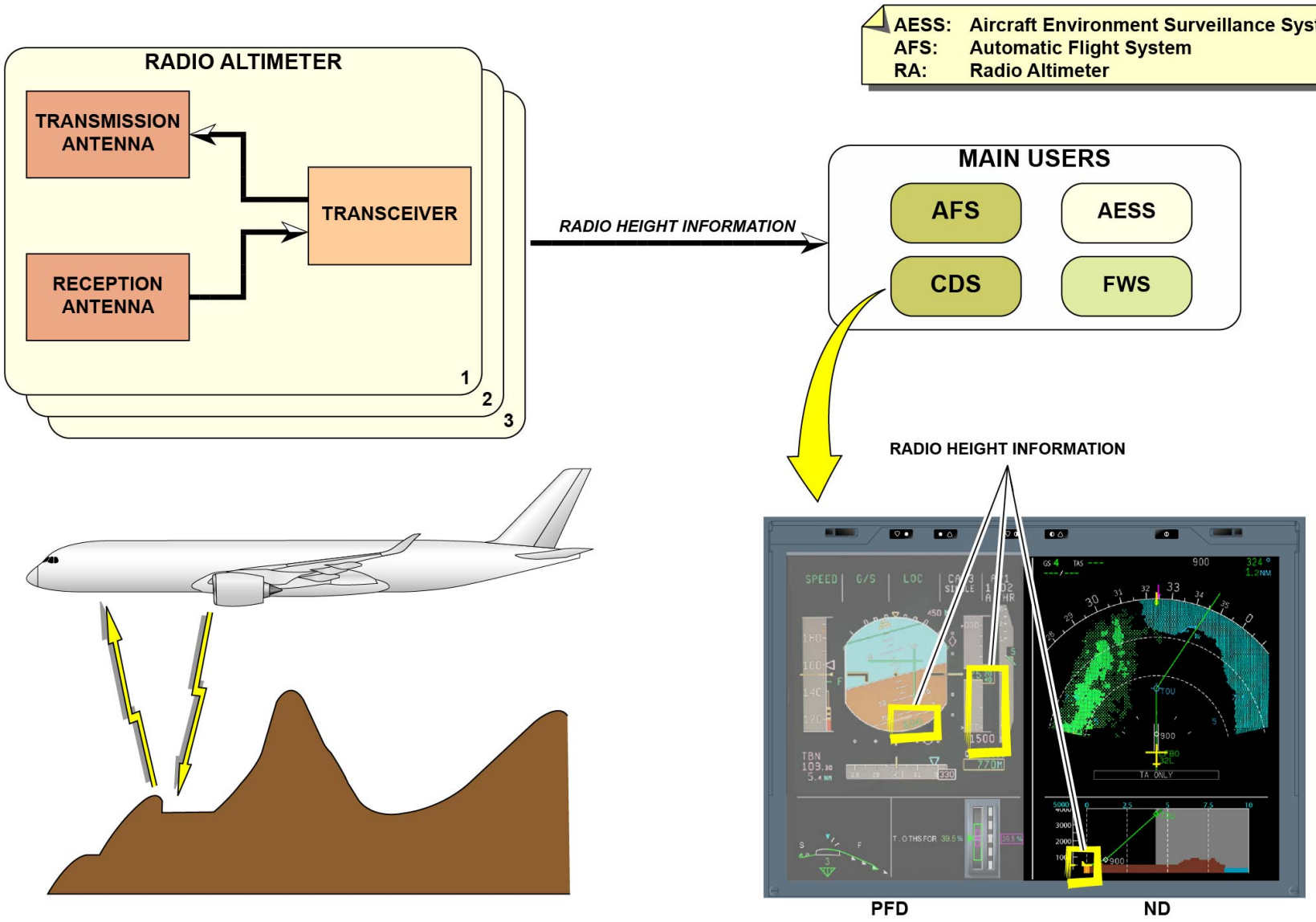
RADIO ALTIMETER SYSTEM DESCRIPTION (2/3)

Radio Altimeter: General

The purpose of the Radio Altimeter (RA) system is to measure the height between the A/C and the ground level.
The radio height information given is the main landing gear wheels height above the ground.
The RA system is made of three subsystems. Each subsystem includes:
- A transceiver
- A transmission antenna
- A reception antenna.

The RAs give the height information to the systems that follow:
- The PRIMary Computers (PRIMs) for the Automatic Flight System (AFS)
- The FWS to supply warnings and radio height call-out
- The Aircraft Environment Surveillance System (AESS) (Terrain Awareness Warning System (TAWS))
- The CDS for height display.

V2414251 - V00T0MM0 - VM34D6RALT03001



RADIO ALTIMETER: GENERAL

V2414251 - V00T0MM0 - VM34D6RALT03001

RADIO ALTIMETER SYSTEM DESCRIPTION (2/3)

Radio Altimeter: Interface

Flight controls system

Each RA transceiver sends data to the PRIMs. The radio height is used for the guidance and to do anti-tail strike protection laws during takeoff and landing. Each PRIM receives radio height and status data to:

- Elaborate parameters for automatic landing
- Enable the Autopilot (AP) engagement
- Consolidate the ground/flight conditions.

The SECondary Computers (SECs) receive data from the AFDX network to calculate the ground/flight logics.

FWS

Each RA transceiver is connected to the FWS application hosted in the CPIOM through an ARINC 429 output bus. Each FWS application gets the radio height data from the three RAs to give warning data and auto call-out.

CDS

The RAs send radio height data to the CDS through the CRDCs and the AFDX network. Data are shown on the PFD artificial horizon part, on the altitude tape and the vertical display part.

LGERS

Each RA transceiver receives the flight/ground condition from the LGERS through a discrete link. This information is used for the flight/ground condition consolidation. When the A/C is in-flight, the interactive mode of the RA BITE function is prevented.

Propulsion Control System (PCS)

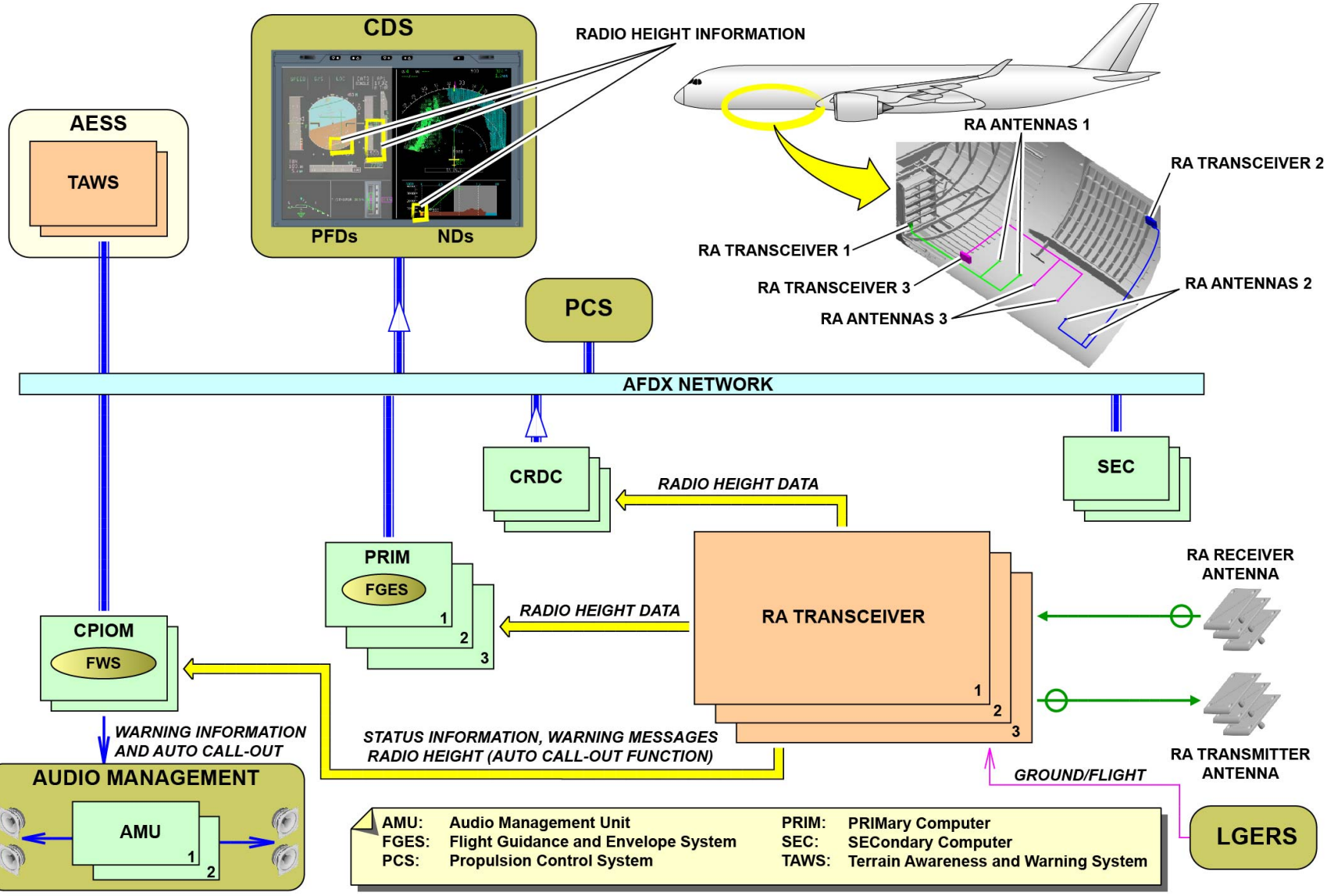
Each RA transceiver receives the engine-running status from the PCS through the AFDX network.

This information is used for flight/ground condition consolidation.

TAWS

The TAWS function is integrated in each AESS and gets the radio height data from the RAs for the surveillance of the terrain proximity.

V2414251 - V00T0MM0 - VM34D6RALT03001



RADIO ALTIMETER: INTERFACE - FLIGHT CONTROLS SYSTEM ... TAWS

V2414251 - V00T0MM0 - VM34D6RALT03001

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

General

The general function of the AESS is to inform the crew about the different types of existing hazards which are external to the A/C on the possible A/C flight paths, such as:
- Atmospheric phenomena: bad weather, windshear, Turbulences (TURBs)
- Terrain/obstacle collision
- Airborne collision.

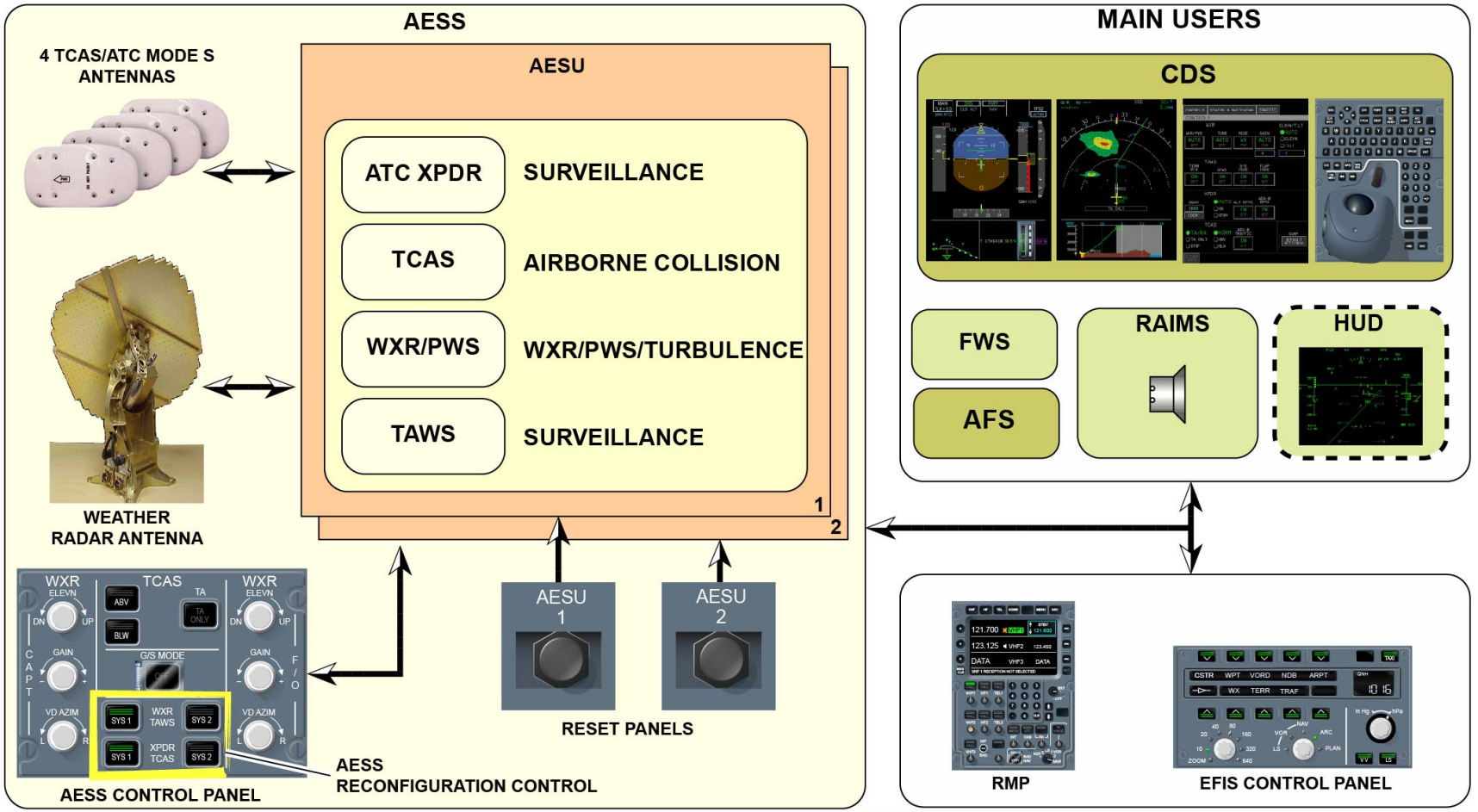
For each hazard, the AESS:
- Informs the crew about the A/C environment
- Detects the hazards
- Alerts the crew if there is an imminent hazard
- Proposes escape maneuvers when possible.

The AESS includes the components that follow:
- Two identical and redundant Aircraft Environment Surveillance Units (AESUs)
- One centralized AESS control panel (with reconfiguration capabilities)
- Four identical (mode S) transponders/Traffic Alert and Collision Avoidance System (TCAS) antennas
- One Weather Radar (WXR) antenna (with related Radar Transceiver Units (RTUs)).

The two AESUs are the primary AESS equipment, which do the functions that follow:
- Air Traffic Control (ATC) Transponder (XPDR) for surveillance
- TCAS to avoid potential airborne collisions
- Weather and Predictive WindShear (PWS)/TURB detection
- Terrain Awareness and Warning System (TAWS).

The warnings and data calculated by the AESUs are shown on the CDS and Head-Up Displays (HUDs), if installed. The aural warnings generated by the AESS are directly sent to the Radio and Audio Integrating Management System (RAIMS).
The FWS also receives the AESS alerts for alert priority management and inhibition.
The Radio and Audio Management Panels (RMPs) can control some ATC XPDR functions (e.g. SQUAWK code).
The EFIS control panels do the selection of the different modes of view on the NDs.
To control the AESS, the KCCUs make the interface with the surveillance pages of the MFDs. The system can be also controlled through the AESS control panel.
In some conditions, the TCAS sends guidance orders to the Autopilot/Flight Director (AP/FD) functions of the Automatic Flight System (AFS).
The flight crew uses the AESU1 (AESU2) reset switches installed on the overhead panel (RESET panel) to do a reset of AESU1 (AESU2).
The AESS can be reconfigured through the AESS control panel after a failure.

V2414251 - V00T0MM0 - VM34D7AESS03001



AESS:	Aircraft Environment Surveillance System	RAIMS:	Radio and Audio Integrating Management System
AESU:	Aircraft Environment Surveillance Unit	RMP:	Radio and Audio Management Panel
AFS:	Automatic Flight System	TAWS:	Terrain Awareness and Warning System
ATC:	Air Traffic Control	TCAS:	Traffic Alert and Collision Avoidance System
HUD:	Head-Up Display	WXR:	Weather Radar
PWS:	Predictive WindShear	XPDR:	Transponder

GENERAL

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

XPDR/TCAS

TCAS and XPDR functions

The TCAS function does an active surveillance of the air traffic to track A/C equipped with the XPDRs to process the range, bearing and relative altitude of this surrounding A/C.
It gives visual and aural indications about surrounding A/Cs and especially alerts about intruders that may imperil the safety of the flight.
The indications give to the flight crew the position of surrounding A/Cs with respect to the own A/C.
The are two types of alerts:
- Traffic Advisories (TAs), that inform the flight crew about the intruders position
- Resolution advisories, that give to the flight crew the position of the threatening intruders and the instructions to avoid collision with them.

The XPDR function has the capabilities that follow:
- Reply to mode A, mode C and mode S interrogations (from surrounding A/Cs and ATC ground stations)
- Support Automatic Dependent Surveillance-Broadcast (ADS-B) OUT: A/C data broadcast.

The XPDR receives interrogations (through 1030 MHz signals) from:
- The ATC ground station for the air traffic management purpose
- The TCAS installed in surrounded A/Cs.

The XPDR automatically replies to the ATC ground-station and/or TCAS interrogations (through 1090 MHz signals).
XPDR transmission modes
The XPDR provides the modes that follow:
- Mode A: transmission of ATC code (A/C identification) or SQUAWK code
- Mode C: mode A + transmission of A/C barometric altitude
- Mode S: mode C + A/C parameters (e.g.: A/C address, flight number, speed, heading, other parameters, etc.)
- ADS-B OUT: permanent broadcast of surveillance data (e.g.: flight number, A/C position, speed, selected altitude, magnetic heading, etc.) to ATC ground stations and other A/Cs.

AESUs XPDR/TCAS functions interfaces

For the XPDR/TCAS functions, each AESU has an interface with some systems:
- The Flight Management System (FMS) through the AFDX network, for acquisition of parameters as the flight number, track angle, etc.
- The RMPs to receive the XPDR/SQUAWK code
- The Air Data/Inertial Reference Units (ADIRUs) for inertial and air data parameters: A/C position, heading, speed, altitude, etc.
- The PRIMary Computers (PRIMs) for vertical guidance orders acquisition used by AP/FD functions
- The LGERS to receive the flight/ground status of the A/C
- The Radio Altimeter (RA) transceivers for radio height information
- For the ADS-B OUT XPDR function, each AESU also receives the selected altitude and selected heading from the Flight Control Unit (FCU) or from the FCU back-up.

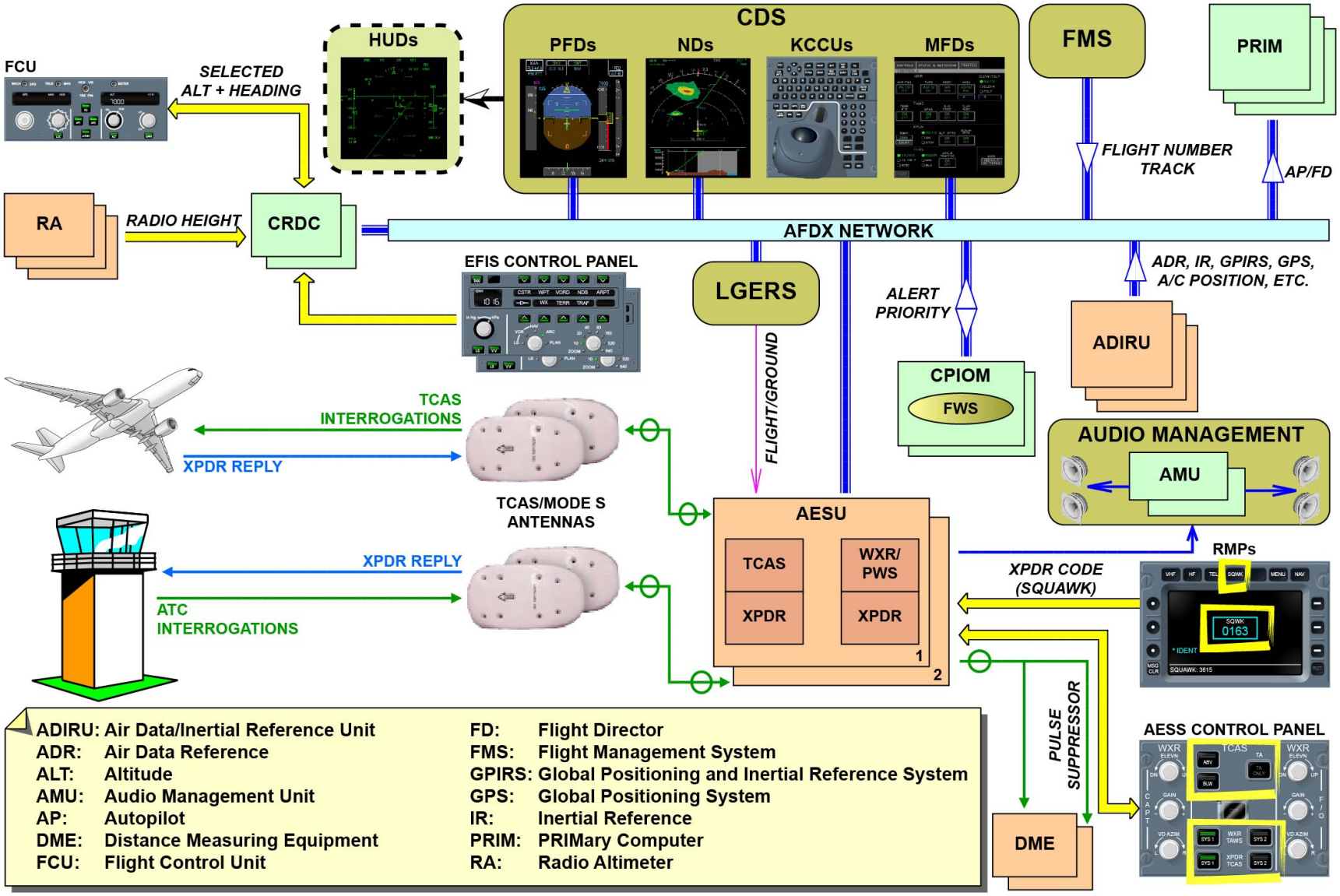
The AESS control panel enables the control system operation and data visualization on the NDs.
The TCAS function can generate visual alerts and information (e.g.: resolution advisories, traffic advisories, proximates, etc.) that are shown on the cockpit displays and on the HUDs, if installed.
The TCAS function can also generate aural alerts (if there are resolution or traffic advisories). For that, the AESUs are connected to the Audio Management Units (AMUs) through analog links. Then the cockpit loudspeakers broadcast the aural alerts.
The AESUs send their aural alerts to the FWS for aural alerts prioritization and inhibition, if relevant.
There are four combined mode S/TCAS antennas, which transmit and receive data for the TCAS and the XPDR functions.
They can receive and transmit:
- The TCAS interrogation signals (at a frequency of 1030 MHz)

V2414251 - V00T0MM0 - VM34D7AESS03001

- The XPDR reply signals (at a frequency of 1090 MHz).

Each AESU is connected to one top antenna and one bottom antenna through coaxial cables.

V2414251 - V00T0MM0 - VM34D7AESS03001



XPDR/TCAS - TCAS AND XPDR FUNCTIONS & AESUS XPDR/TCAS FUNCTIONS INTERFACES

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V2414251 - V00T0MM0 - VM34D7AESS03001

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

WXR/PWS

WXR/PWS functions

The A/C is equipped with a dual WXR function with PWS and TURB detection. The PWS/WXR enables the detection and the localization of atmospheric disturbances in the area defined by the antenna scanning (± 80° azimuth, ± 15° in tilt and up to 320 NM in front of the A/C).

The weather reflectivity is shown on the ND and vertical display with black, green, yellow, magenta and red colors.

In addition, the WXR can also give the ground mapping capability.

The main equipment of the WXR system is:

- The WXR flat plate
- The weather antenna drive unit
- The RTUs.

The scanning pattern of the mechanical antenna is de-coupled from the weather images on the displays. The radar system continuously scans the full space in front of the A/C and stores all reflectivity data in a volumetric buffer. This buffer is continuously updated with reflectivity data from new scans and data are shifted to take into account the A/C movement (speed, heading, altitude).

The standard horizontal view (on the ND) shows a related weather envelope around the flight plan from the FMS (or operates on the vertical speed). The vertical profile views (on the vertical display) are cut through the buffer

- At the track angle of the A/C or
- At a manually chosen azimuth angle.

The vertical views can also be given along the FMS flight plan.

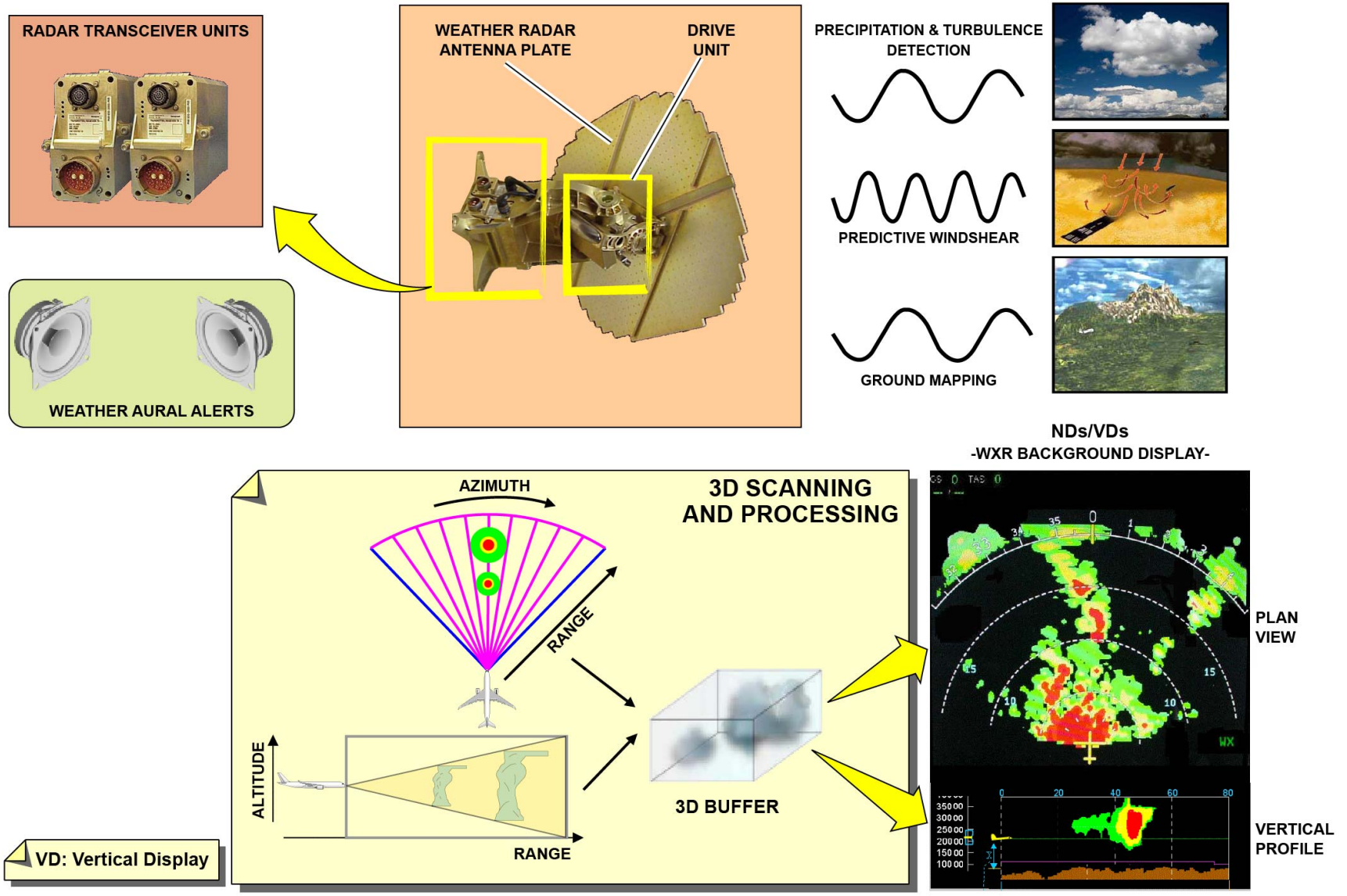
The horizontal and vertical views are given independently for the CAPT and F/O.

The images related to these atmospheric disturbances (precipitations or TURBs) are shown in different colors on the horizontal and vertical display windows of the ND. These colors are related to the intensity of the precipitation and the TURB areas.

On the HUDs (optional), only predictive windshear alert messages are shown.

The WXR/PWS alerting system can give visual and aural alert in case of severe weather conditions or windshear area in front of the A/C.

V2414251 - V00T0MM0 - VM34D7AESS03001



WXR/PWS - WXR/PWS FUNCTIONS

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

WXR/PWS (continued)

WXR/PWS interfaces

The main equipment of the WXR system is:
- An antenna plate
- A weather antenna drive unit
- A RTU
- A wave guide switch.

Antenna plate

The WXR antenna plate does the transmission and reception of signal to fulfill the WXR, PWS and TURB functions.

Weather antenna drive unit

The weather antenna drive unit includes:
- The radar RF switch that allows to use RTU1 or 2
- A drive unit (electrical motors) to mechanically control the WXR antenna plate position (tilt and azimuth angles).

The weather antenna drive unit is continuously monitored (delta between commanded position and position sensor reading).

RTUs

The active RTU does the functions that follow:
- Does the interface between the AESU and the weather antenna drive unit, to control the antenna plate position (azimuth and tilt) through an analog signal
- Gives and receives WXR RF signals to/from the antenna plate through the RF switch
- Gives measurement feedback to its related AESU through coaxial cables
- Gives power supply to the antenna drive unit.

Note: the RTU software is a field loadable software. It is automatically loaded by the AESU WXR operational software, when required.

For the WXR/PWS functions, each AESU has an interface with some systems:
- The FMS for parameters as the track angle, flight plan data, etc.
- The ADIRUs for A/C position, heading, speed, altitude, etc.
- The Propulsion Control system (PCS), to get the engine on or off status and the engine takeoff configuration (used for the WXR and PWS automatic activation)
- The LGERS to receive the flight/ground status of the A/C
- The RAs transceiver for radio height information (used for the PWS inhibition in-flight)
- The FCU or the FCU back-up application (MFD) for the selected altitude and the AP engagement status.

If there are severe weather conditions or windshear areas in front of the A/C, the WXR/PWS can generate visual and aural alerts:
- The WXR/PWS function generates visual alerts that are shown on the cockpit displays and on the HUDs, if installed.
- The WXR/PWS function can also generate aural alerts. For that, the AESUs are connected to the AMUs through analog links. Then the cockpit loudspeakers broadcast the aural alerts.

The AESUs send its aural alerts to the FWS for aural alert prioritization and inhibition, if relevant.

On ground, the WXR function operates automatically when at least one engine is running and if the CAPT (or F/O) EFIS WXR P/BSW is pushed (and if WXR/PWS P/BSW is not in OFF position on the MFD). In-flight, it operates without conditions.

The PWS function operates automatically on ground if the WXR operates and if, at least, one engine is at takeoff power. In-flight, the PWS function operates automatically depending on the radio altitude (below 2300 feet).

The MFD surveillance control page and WXR control panels enable to set all the modes given for the WXR control. The related weather display follows an available FMS flight plan or a flight path angle envelope. The manual modes can be chosen directly on the CAPT and F/O WXR control panels or on the MFD surveillance page.

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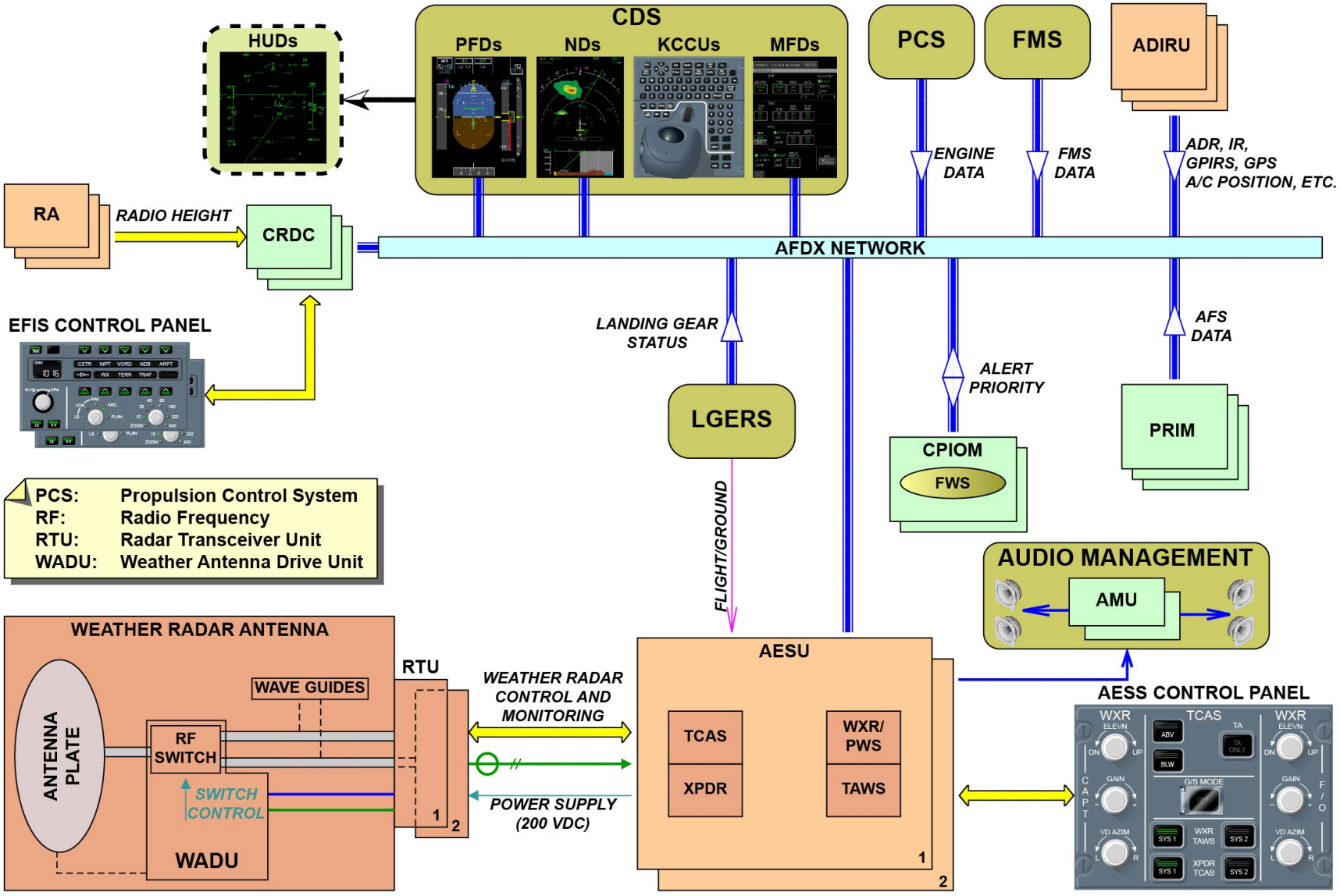

WXR/PWS - WXR/PWS INTERFACES

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

TAWS

TAWS functions

The function of the TAWS is to alert the flight crew to prevent A/C collision with the terrain.
To do this function, the system processes a lot of A/C parameters and the AESU terrain data of the database. Then, it can give to the crew the aural alert messages and visual annunciations and displays if the boundaries of any alerting envelope are exceeded.
Some main alerting functional areas are integrated into the TAWS:
- The basic Ground Proximity Warning System (GPWS) - (GPWS modes 1 to 5 also called reactive modes), which can generate reactive aural alerts
- The enhanced modes (also called predictive modes), which can generate both aural and visual alerts.

The enhanced modes consist in two main functions:
- Terrain and runway clearance floors
- Terrain/obstacle awareness, alerting and display.

TAWS interfaces

For the TAWS functions, each AESU has an interface with some systems:
- The FMS for parameters like the flight plan data, track angle, etc.
- The ADIRUs for inertial and air data parameters: A/C position, heading, speed, altitude, etc.
- The Multi-Mode Receivers (MMRs) for the Glide Slope (G/S) deviation (GPWS G/S mode 5)
- The LGERS to receive the flight/ground status of the A/C
- The RAs transceiver for radio height information
- The SFCCs for slats/flaps position.

Each AESU also receives the selected altitude from the FCU or from the FCU back-up application (MFD).
The TAWS function can generate visual and aural alerts:
- The visual alerts are shown on the cockpit displays and on the HUDs, if installed.
- For the aural alerts, the AESUs are connected to the AMUs through analog links. Then the cockpit loudspeakers broadcast the aural alerts.

The AESUs send its aural alerts to the FWS for aural alert prioritization and inhibition if relevant.
To control the TAWS function, the flight crew can use the AESS control panel (G/S mode P/BSW) to prevent one specific alert (GPWS G/S mode 5). The flight crew can also use the CONTROL page on the CAPT (F/O) MFD to set all the operation modes of the TAWS functions.
On the CAPT (F/O) EFIS control panel, the TERR P/BSW is used to display the terrain image on the ND.

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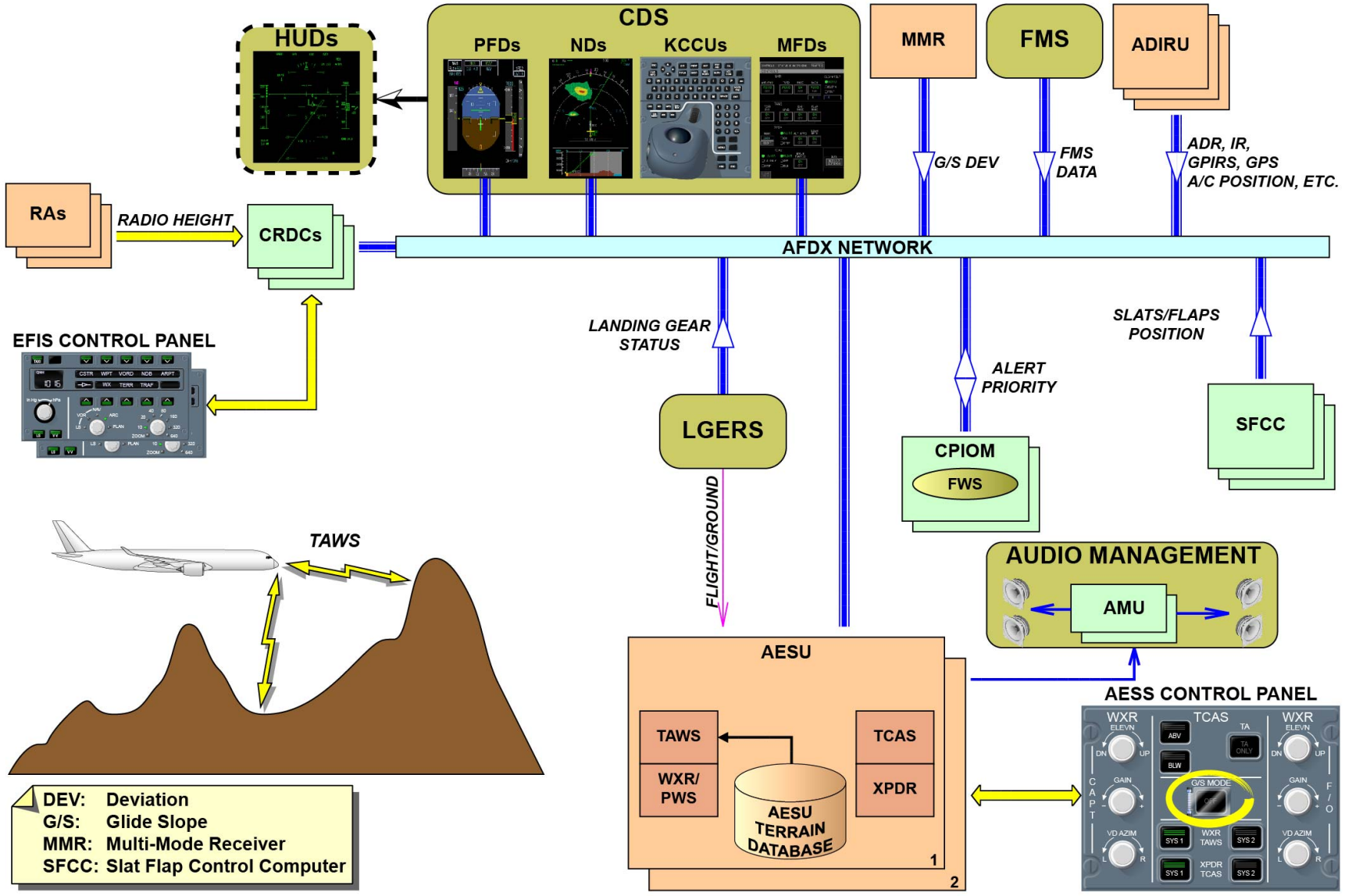

TAWS - TAWS FUNCTIONS & TAWS INTERFACES

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) DESCRIPTION (2/3)

AESS Reconfiguration

The surveillance functions are divided in two function groups in the AESU:
- The WXR/PWS and TAWS functions are in the WXR/TAWS group
- The TCAS and XPDR functions are in the TCAS/XPDR group.

The AESS has three modes of operation:
- Normal mode
- Mixed mode
- Downgraded mode.

In normal and in mixed mode, only one AESU sends data to the A/C system (AMU, FWS, CDS, etc.): this AESU is the master AESU.
The master AESU is the one with the WXR/TAWS function group operated on the AESS control panel or on the STATUS and SWITCHING page of the SURV menu on the MFDs. The other AESU, which is the non-master AESU, sends data to the master AESU only.

Normal mode

In normal operation, only one AESU does all the functions (the two function groups are started in one AESU).
The master AESU does all the surveillance functions.
(For an odd flight number, the AESU1 is master and for an even flight number, the AESU2 is master).

Mixed mode

In mixed mode, the two function groups are available. The functions are shared between the two AESUs (with or without failure).
One function group is operated in one AESU while the other function group is operated in the other AESU. Only the master AESU sends data to the other A/C systems.

Downgraded mode

The AESS is in downgraded mode when one or many functions are completely lost. For example the same surveillance function or function group is not available in the two AESUs.

Controls

To operate the WXR/TAWS and/or TCAS/XPDR function groups in AESU1 (AESU2), the flight or maintenance crew manually select the SYS1 (SYS2) P/BSW on:
- The AESS control panel or
- The STATUS and SWITCHING page in the SURV menu of the CAPT or F/O MFD.

The AESU with the WXR/TAWS function group started is the master AESU and is the one which sends data to the A/C systems.
The other AESU, which is the non-master AESU, sends data to the master AESU only.

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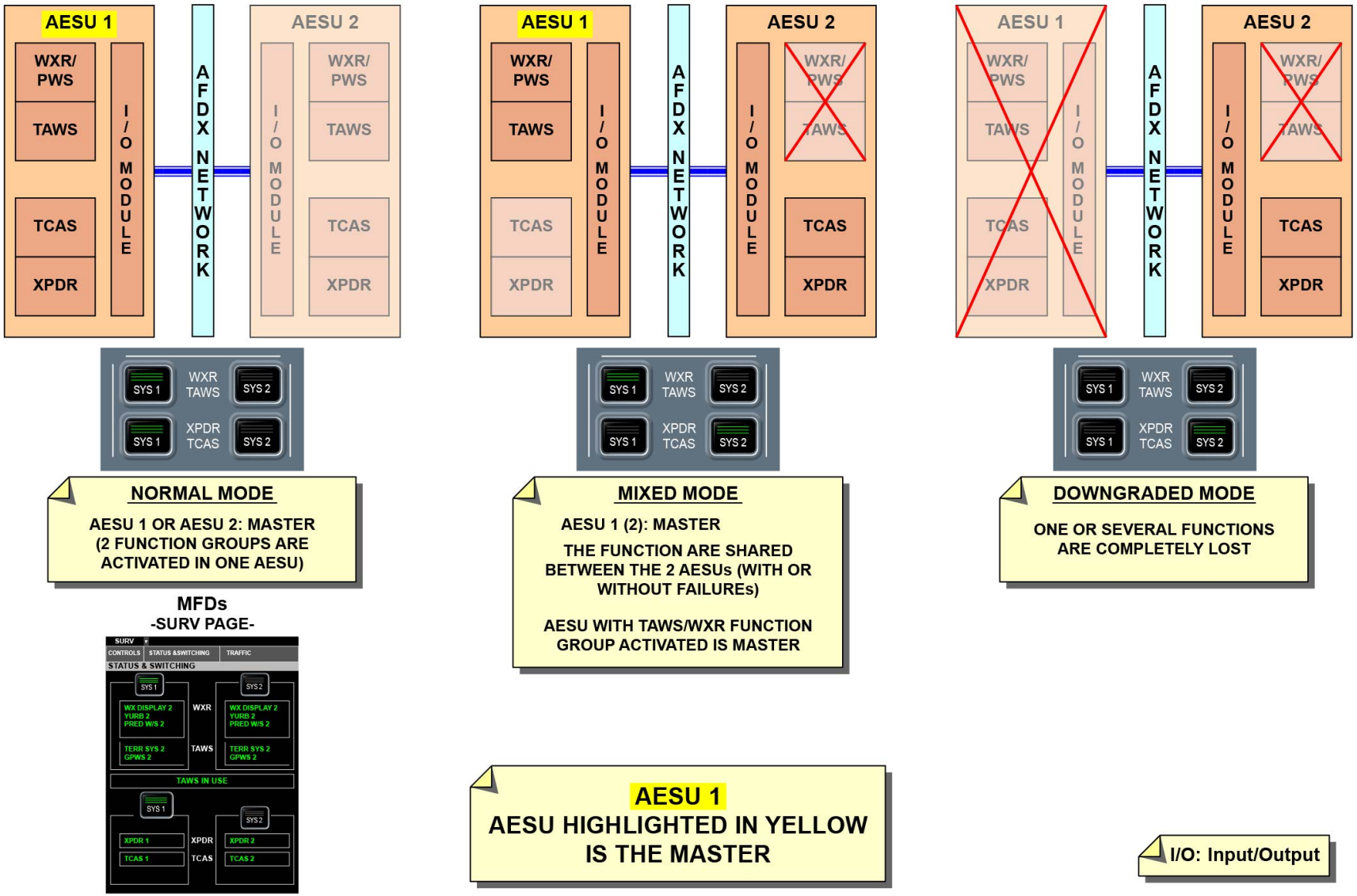

AESS RECONFIGURATION

AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) CONTROL AND INDICATING (2)

AESS Operation (2)

AESS control is performed through the following means:
− One shared AESS Centralized Control Panel,
− CAPT and F/O MFD AESS dedicated pages through KCCU,
− RMP 1 2 and 3,
− EFIS Control Panel CAPT and F/O (FCU 1 and 2, FCU Backup 1 and 2),
− ECAM Control Panel,
− Reset Controls (one per AESU),
It allows the control of functions that necessitate direct access from the flight crew. The same, and all the other SURV control means are available from the Cockpit Display System (CDS) interactive windows (MFD pages) dedicated to the AESS.
Note: Each action on a common control from Control Panel or MFD page changes the indication status on both controls.
There is no normal case where SYS1 and SYS2 green bars of a same group be illuminated together or extinguished together.
Pressing the XPDR/TCAS SYS1 key when not illuminated has the following effect:
- selection of the [XPDR/TCAS] group on the AESU1,
- illumination of the three green bars on the SYS1 key,
- de-selection of the [XPDR/TCAS] group on the AESU2,
- extinction of the three green bars on the SYS2 key,
Pressing the XPDR/TCAS SYS1 key when illuminated has no effect on the AESU.
It is the same for XPDR/TCAS SYS2 key.
TA ONLY mode: This selection enables to control the TA ONLY selection of TCAS.
The logic used to select between TA ONLY and TA/RA is the following:
- Pressing the "TA ONLY" key when not illuminated cause the selection of the TA ONLY mode of TCAS,
- Pressing the "TA ONLY" key when illuminated cause the selection of TA/RA mode of TCAS.
On ND: white "TA ONLY" message on TCAS zone when "TRAF" or "TRAF ID" is selected on EFIS
CP
The AESS is interfaced with the CDS for the AESS control through 2 MFD pages (one for CAPT and one for F/O).
So within SURV MFD environment, there are 3 pages: CONTROLS, STATUS & SWITCHING, TRAFFIC.
Traffic page contains 2 folders TRAFFIC DATA and ITP.
To access to the AESS Control MFD pages:
- Select SURV field on the left bottom box on MFD DU or press the SURV button on the KCCU.
When pilot prompts SURV button on KCCU or when he/she chooses the MFD SURV menu:
If an AESS failure occurs or after the aircraft power on, the CONTROLS page is opened.
Else the last SURV page used is opened
TERR SYS ON/OFF switch: The OFF selection enables the permanent inhibition of the TAD and
TCF TAWS enhanced functions if confirmed (If cancelled, the OFF selection is aborted)
Cockpit effects linked to TERR SYS ON/OFF control:
- ECAM memo: green "TERR SYS OFF" in case of OFF selection,
- ND right lower corner message zone: white "TERR SYS OFF" in case of OFF selection.
WX / MAP modes: This selection enables the following functions:
- WX mode selection for the WXR/PWS function,
- MAP mode selection for the WXR/PWS function.
This setting can be applied independently on CAPT and F/O side.
Cockpit effects linked to MODE WX/MAP control:
- ND right lower corner message zone when WX display selected on EFIS CP:

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- green "WX" when WX mode selected,
- cyan "MAP" when MAP mode selected.

Cockpit effects linked to TCAS TA/RA / TA ONLY / STBY control.
When TA/RA mode selected:
- No cockpit effect

When TA ONLY mode selected:
- ND message: white "TA ONLY" on TCAS zone if the "TRAF" or "TRAF ID" is active on FCU AND Arc or Rose-Nav mode is active AND ZOOM mode is not active.

When STBY mode selected:
(A confirm box is opened to validate the choice - see Figure 117: MFD TCAS Modes Control button).
- On SURV MFD page: TCAS NORM/ABV/BLW controls are set disabled, and currently selected option button remains selected.
- ECAM memo: green "TCAS STBY" memo,
- On ND TCAS zone: "TCAS STBY" flag is displayed if the "TRAF" or "TRAF ID" is active on FCU and Arc or Rose-Nav mode is active and ZOOM mode is not active, in white color when A/C is on ground and amber color when A/C is in air.

MFD STATUS & SWITCHING page
In the STATUS & SWITCHING page the crew has the possibility to switch the groups of function between both AESUs.
WXR/TAWS SYS 1/SYS 2 push buttons: these push buttons allow switching between the WXR/TAWS group on AESU1 and AESU2.
XPDR/TCAS SYS 1/SYS 2 push buttons: these push buttons allow switching between the XPDR/TCAS group on AESU1 and AESU2.
EFIS Control Panel CAPT and F/O
Both EFIS CP, CAPT (part of FCU 1) and F/O (part of FCU 2), control each AESU for RANGE, ND DISPLAY MODE and AESS DISPLAY MODE.
WX switch: when pressed, the Weather information is displayed on respective CAPT or F/O ND and/or VD with respect to the WXR/PWS mode selection.
When not pressed, the WXR/PWS operates in Pop Up mode.
The WXR/PWS information display can be selected with TCAS display selection, but not with TERR display selection.
When WXR display is ON, TERR display is set to OFF automatically.
TRAF switch:
− The TRAF button is a three state cyclic button when the ADS-B TRAFFIC button is set ON (on MFD SURV / CONTROL page), when successively pressed, the TRAF button has the following states:
NO TRAF state: there is no traffic display on ND (TCAS, ADS-B, TCAS/ADS-B), the button is not activated. The TCAS operates in Pop Up mode (called THREAT mode) that allows the display of all TCAS intruders only when a TA or RA is displayed.
TRAF state: there is traffic display on ND (TCAS Only or ADS-B Only or TCAS/ADS-B according to SURV MFD Settings), the button is activated,
ID state: there is traffic display on ND adding with Flight Identification for all ADS-B symbol and TCAS/ADSB symbol. The ID state is also activated when the FLIGHT ID DISPLAY button on MFD SURV TRAFFIC DATA page is set to ON.
− when the MFD ADS-B TRAFFIC button is set OFF or ATSAW BASIC unit activated, the TRAF button becomes a 2 states button
TRAF state, the TCAS symbols, operating mode messages and fault data are displayed on respective CAPT or F/O ND with respect to the AUTO / ABV / BLW and TA/RA / TA ONLY / STBY TCAS mode selections.
NO TRAF state, the TCAS operates in Pop Up mode (called THREAT mode) that allows the display of all TCAS intruders only when a TA or RA is displayed.
The TCAS intruder's display can be selected when WX or TERR display is selected.
TERR switch: when pressed, the Terrain information is displayed on respective CAPT or F/O ND with respect to the TERR mode selection.
When not pressed, the TAWS operates in Pop Up mode.
The TAWS information display can be selected with TCAS display selection, but not with WX display selection. When TERR display is ON, WXR display is set to OFF automatically.

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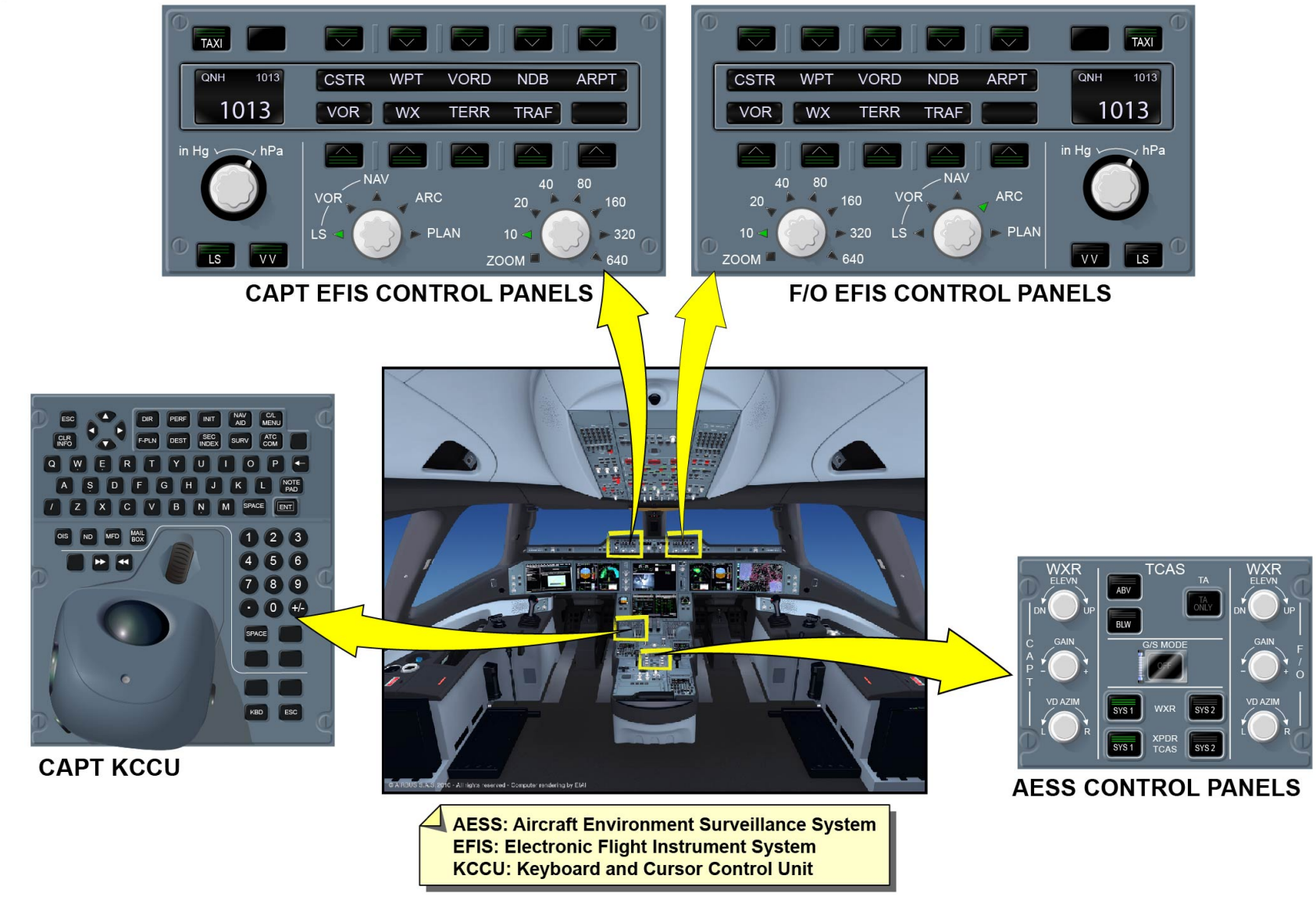
CAPT EFIS CONTROL PANELS
F/O EFIS CONTROL PANELS
CAPT KCCU
AESS CONTROL PANELS
AESS: Aircraft Environment Surveillance System
EFIS: Electronic Flight Instrument System
KCCU: Keyboard and Cursor Control Unit

AESS OPERATION (2)

AESS OPERATION (2)

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MFD CONTROL PAGE

AESS OPERATION (2)

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AIRCRAFT ENVIRONMENT SURVEILLANCE SYSTEM (AESS) CONTROL AND INDICATING (3)

AESS Operation (3)

AESS control is performed through the following means:
− One shared AESS Centralized Control Panel,
− CAPT and F/O MFD AESS dedicated pages through KCCU,
− RMP 1 2 and 3,
− EFIS Control Panel CAPT and F/O (FCU 1 and 2, FCU Backup 1 and 2),
− ECAM Control Panel,
− Reset Controls (one per AESU),
It allows the control of functions that necessitate direct access from the flight crew. The same, and all the other SURV control means are available from the Cockpit Display System (CDS) interactive windows (MFD pages) dedicated to the AESS.
Note: Each action on a common control from Control Panel or MFD page changes the indication status on both controls.
There is no normal case where SYS1 and SYS2 green bars of a same group be illuminated together or extinguished together.
Pressing the XPDR/TCAS SYS1 key when not illuminated has the following effect:
- selection of the [XPDR/TCAS] group on the AESU1,
- illumination of the three green bars on the SYS1 key,
- de-selection of the [XPDR/TCAS] group on the AESU2,
- extinction of the three green bars on the SYS2 key,
Pressing the XPDR/TCAS SYS1 key when illuminated has no effect on the AESU.
It is the same for XPDR/TCAS SYS2 key.
From SQWK from the key on top of the RMP:
- Press the SQWK button on the top of the RMP.
- Enter the new code at the numerical keyboard. If the code is in the correct range [0000 - 7777], it is automatically validated after 3 sec.
To perform an Ident:
- Press the SQWK button on the top of the RMP.
- Press the Line selection key near to the IDENT command.
SURV DEFAULT SETTINGS button: the default settings selection, if confirmed, enables to come back to the ground set up configuration. If cancelled, the action is aborted.
When DEFAULT SETTINGS is selected on CAPT side (respectively on F/O side), the AESS changes the state of Captain Functions (respectively on F/O side) to the following system configuration:
Captain Controls State
WXR mode WX
GAIN mode AUTO
ELEVN/TILT mode AUTO
When DEFAULT SETTINGS is selected on CAPT side or F/O side, the AESS changes the state of Captain and F/O functions to the following system configuration:
Single Controls State
WXR/PWS activation AUTO
XPDR mode AUTO
ALT RPTG ON
TCAS mode TA/RA
TCAS display NORM
TURB detection AUTO
TERR SYS ON
GPWS SYS ON
G/S MODE ON
Flap MODE ON
ADS-B RPTG ON
When DEFAULT SETTINGS is selected on CAPT side or F/O side and if ATSAW Basic is activated by SPP, the AESS changes the state of Captain and F/O functions to the following system configuration:
Single Controls State
ADS-B TRAFFIC ON
SQWAK code remains unchanged.
MFD XPDR Code / IDENT control

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CODE field: This field enables to enter the CODE (0-7777) through the Cursor Control Device (CCD).
IDENT push button: This push button (bi-stable) enables to generate an additional identification pulse in the reply signal.
Cockpit effects linked to SQWK entry:
− On RMP: update SQWK value
AUTO / STBY / ON modes: This selection enables to control the transponder mode (STBY needs
to be confirmed by a confirm box. If cancelled, the selection is aborted).
See section 5.3.1.7 for a description of the function.
Cockpit effects linked to XPDR AUTO/STBY/ON modes:
When AUTO mode selected:
− AUTO mode is displayed in the RMP SQWK page and is not displayed in the message line of RMP.
When ON mode selected:
− ON mode is displayed in the RMP SQWK page and on the message line of HF, VHF and TEL page of RMP.
When STBY mode selected:
(A confirm box is opened to validate the choice - see Figure 120: MFD XPDR Mode Control button)
− On MFD SURV page:
. TCAS TA RA/TA ONLY/STBY controls are set disabled, and currently selected option button remains selected,
. TCAS NORM/ABV/BLW controls are set disabled, and currently selected option button remain selected,
. ALT RPTG and ADS-B RPTG buttons are set OFF and disabled,
. ADS-B display is set OFF and disabled if SPP ATSAW basic is activated.
− On ND TCAS zone: "TCAS STBY" flag is displayed if the "TRAF" or "TRAF ID" is active on FCU and Arc or Rose-Nav mode is active and ZOOM mode is not active, in white color when A/C is on ground and amber color when A/C is in air.
− ECAM memo: green "XPDR STBY" and "TCAS STBY" memo are displayed,
− STBY mode is displayed in the RMP SQWK page and on the message line of HF, VHF, and TEL page of RMP

CAPT KCCU

AESS: Aircraft Environment Surveillance System
EFIS: Electronic Flight Instrument System
KCCU: Keyboard and Cursor Control Unit

RMP

AESS CONTROL PANELS

AESS OPERATION (3)

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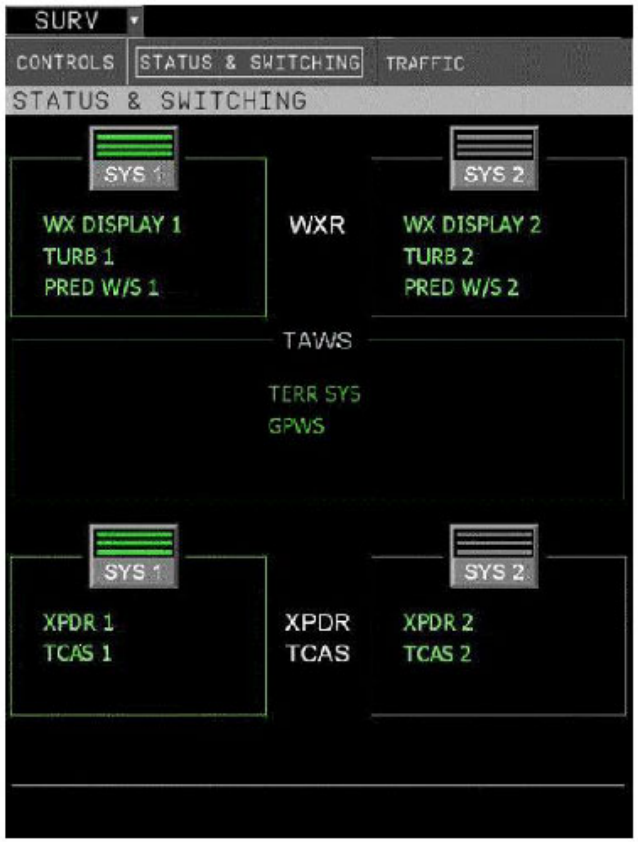

AESS OPERATION (3)

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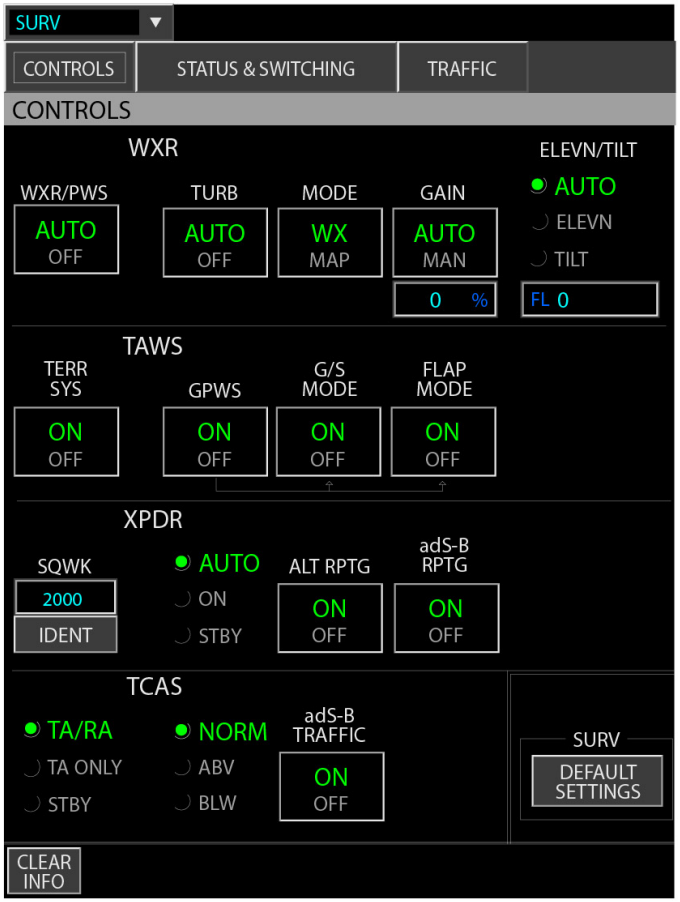

MFD SURV PAGE CONTROLS TAB

AESS OPERATION (3)

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